United States Patent [19]

Taguchi et al.

[11] **Patent Number: 5,058,217**

[45] **Date of Patent: Oct. 22, 1991**

[54] **WATER CLOSET BLOWING WARM AIR AND WATER CLOSET UNIT ATTACHABLE TO TOILET ROOM**

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[73] Assignees: **Inax Corporation; Nippondenso Co., Ltd.,** both of Aichi, Japan

[21] Appl. No.: **342,031**

[22] Filed: **Apr. 24, 1989**

[30] **Foreign Application Priority Data**

Apr. 22, 1988	[JP]	Japan	63-100945
Apr. 28, 1988	[JP]	Japan	63-107235
Apr. 29, 1988	[JP]	Japan	63-108064
May 10, 1988	[JP]	Japan	63-60609
May 10, 1988	[JP]	Japan	63-60610
May 10, 1988	[JP]	Japan	63-60612
May 10, 1988	[JP]	Japan	63-60618

[51] **Int. Cl.**[5] **E03D 11/00**

[52] **U.S. Cl.** **4/420**

[58] **Field of Search** ..... 4/420, 662, 408, 251, 4/233, 111.1, 209 R, 216, 545, DIG. 6, 420.2

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Primary Examiner—Henry J. Recla
Assistant Examiner—Glenn T. Barrett
Attorney, Agent, or Firm—Sherman and Shalloway

[57] **ABSTRACT**

A sitting type water closet, comprising a toilet bowl, a warm air path for conveying the warm air to a front portion of the bowl, and warm air outlet disposed in a front portion of the bowl. Further, a water closet unit capable of attaching the same to a toilet room and blowing warm air out, comprising: an adapter having a means for fixing the adapter to the toilet room, and a warm air generator; and a sitting type water closet having a warm air duct for conveying warm air from the generator to a space in front of the water closet; the water closet being attached at the rear portion thereof to the adapter, and furthermore, a prefabricated toilet room unit including the above water closet unit are also disclosed.

2 Claims, 45 Drawing Sheets

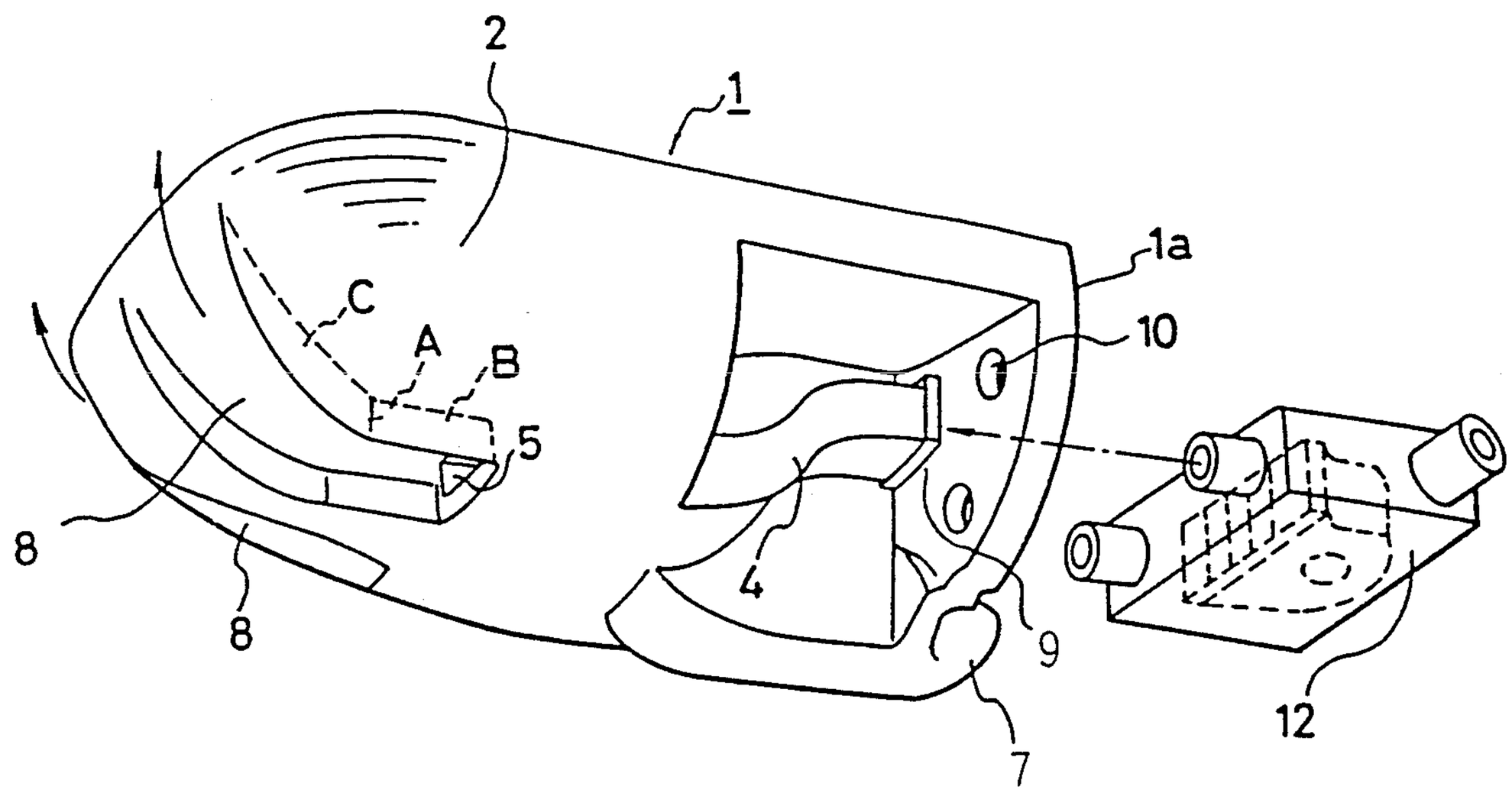
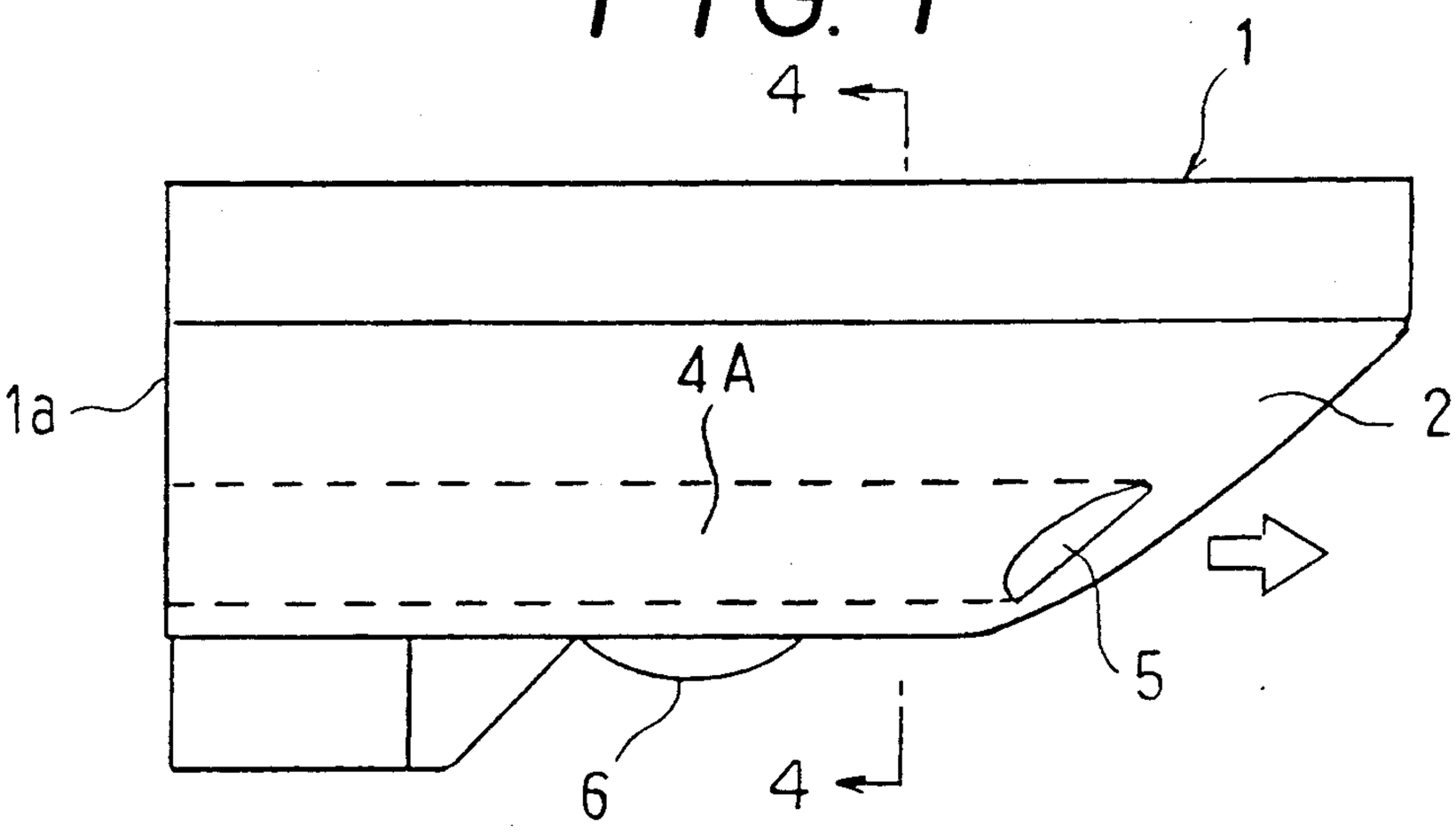


FIG. 1



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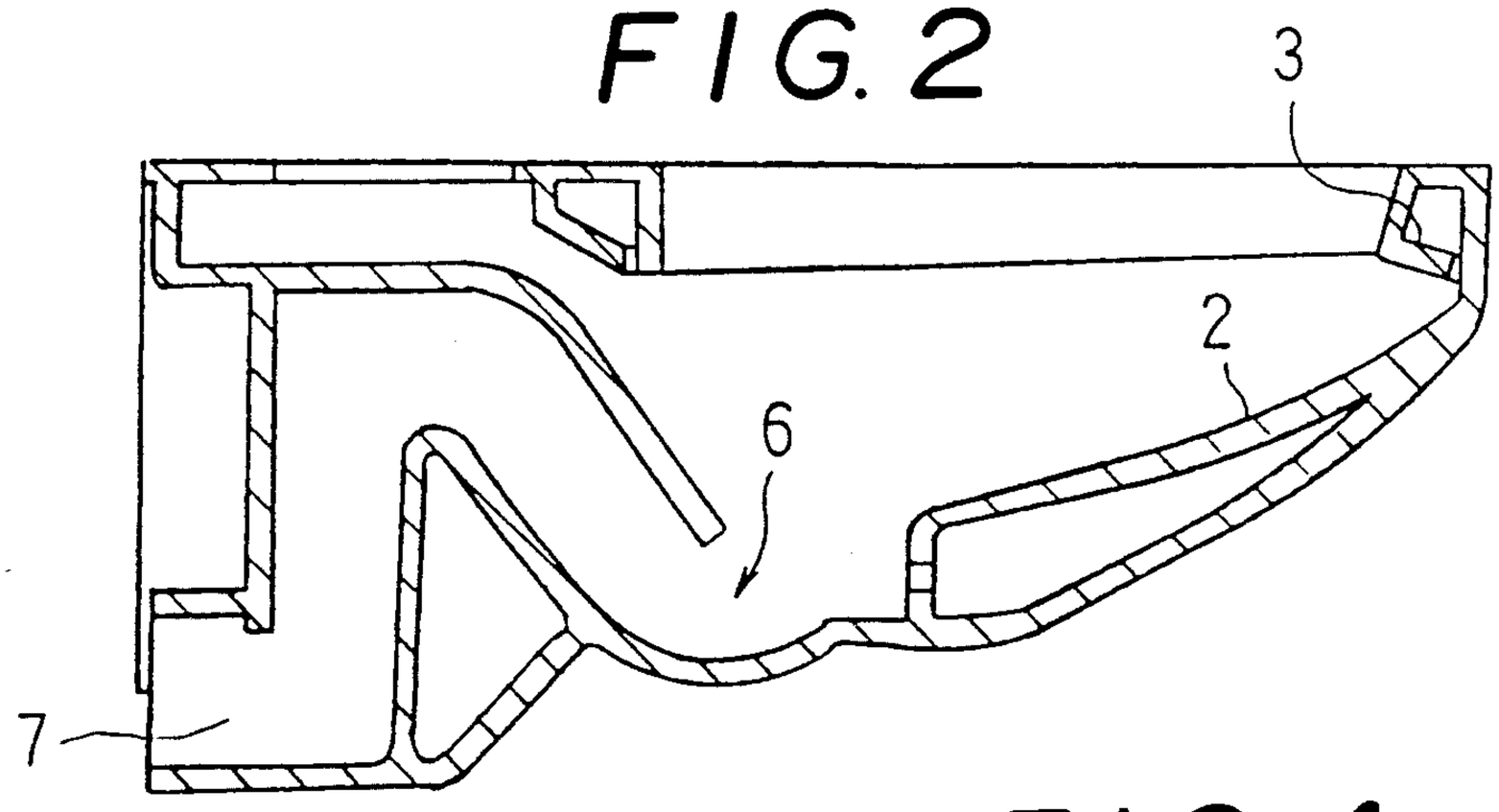
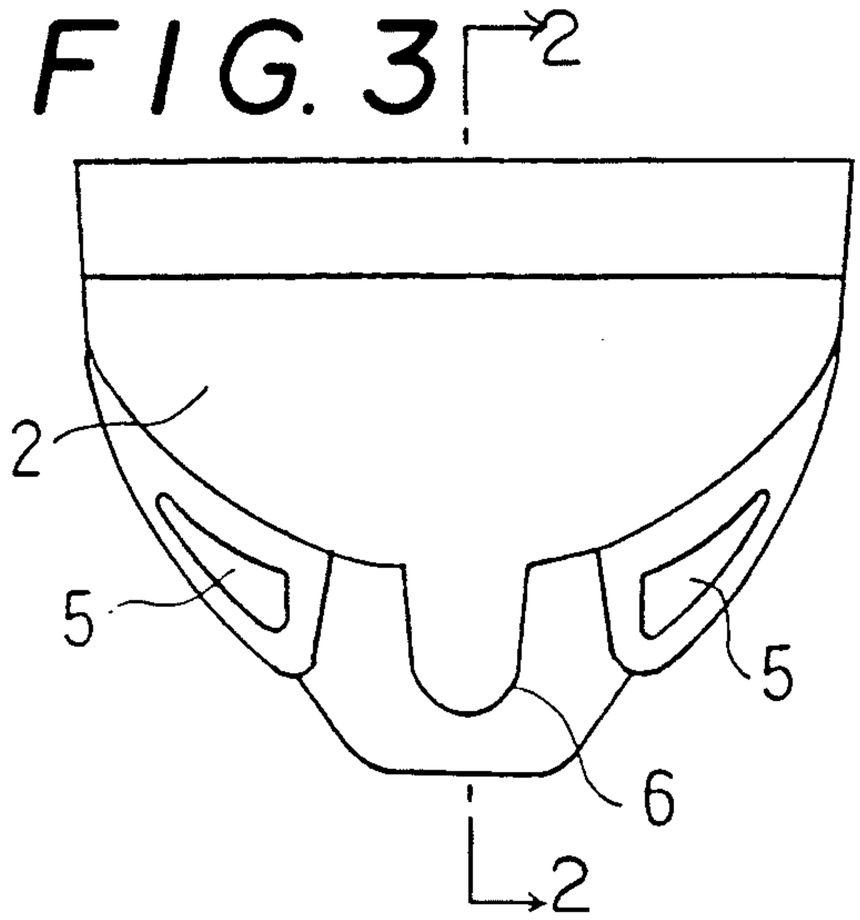
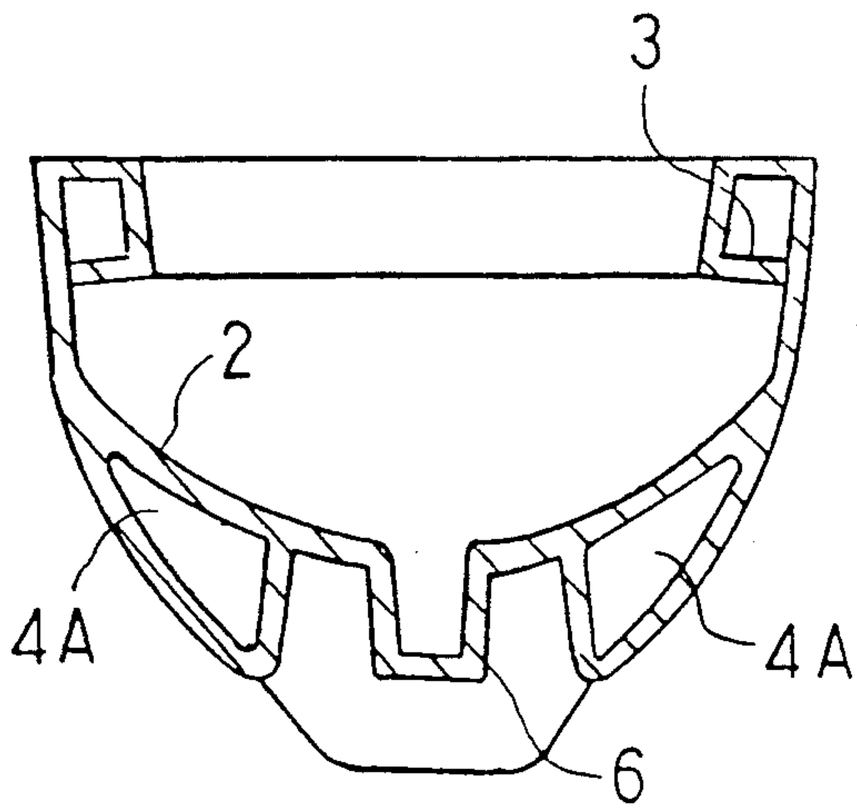


FIG. 4

FIG. 3





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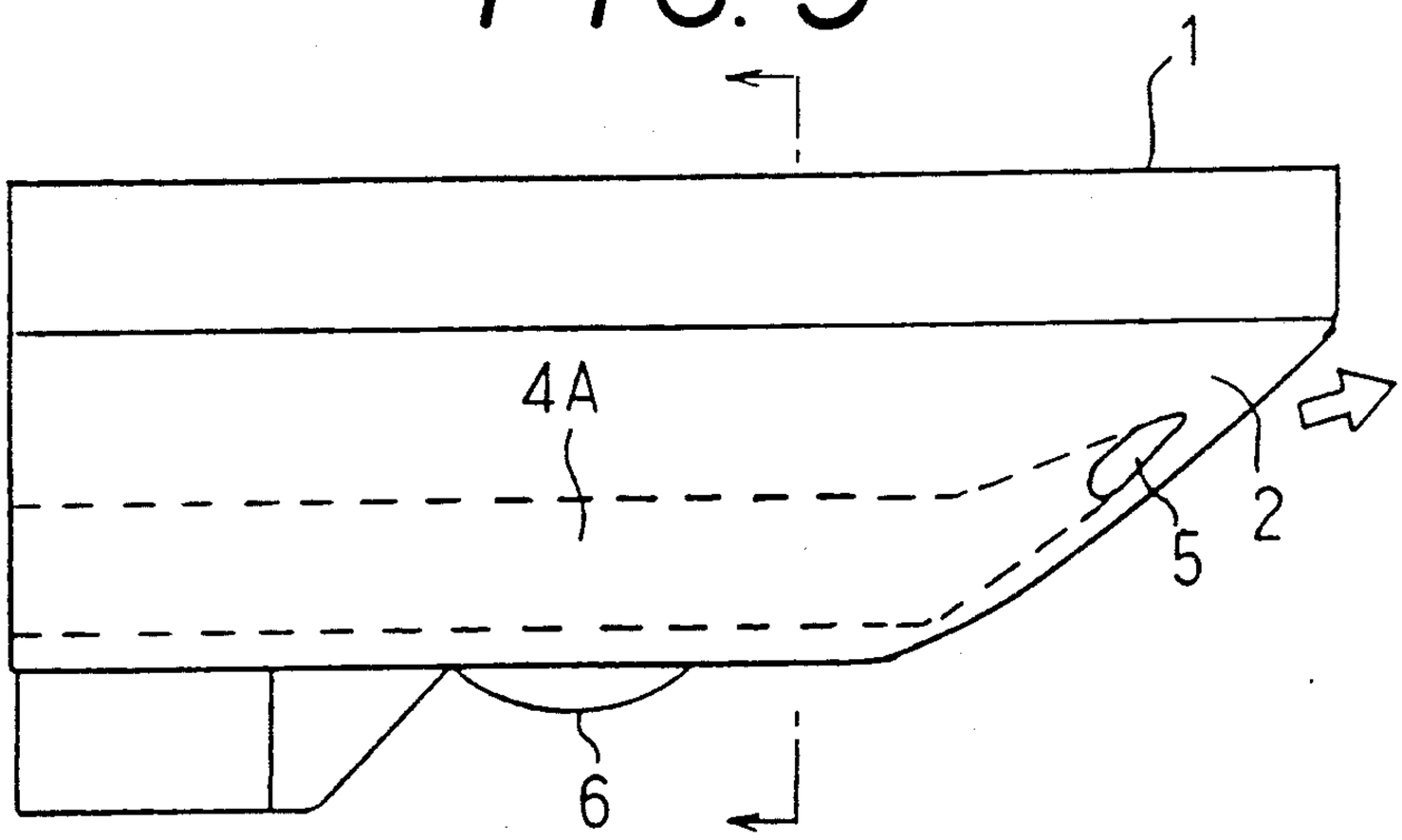

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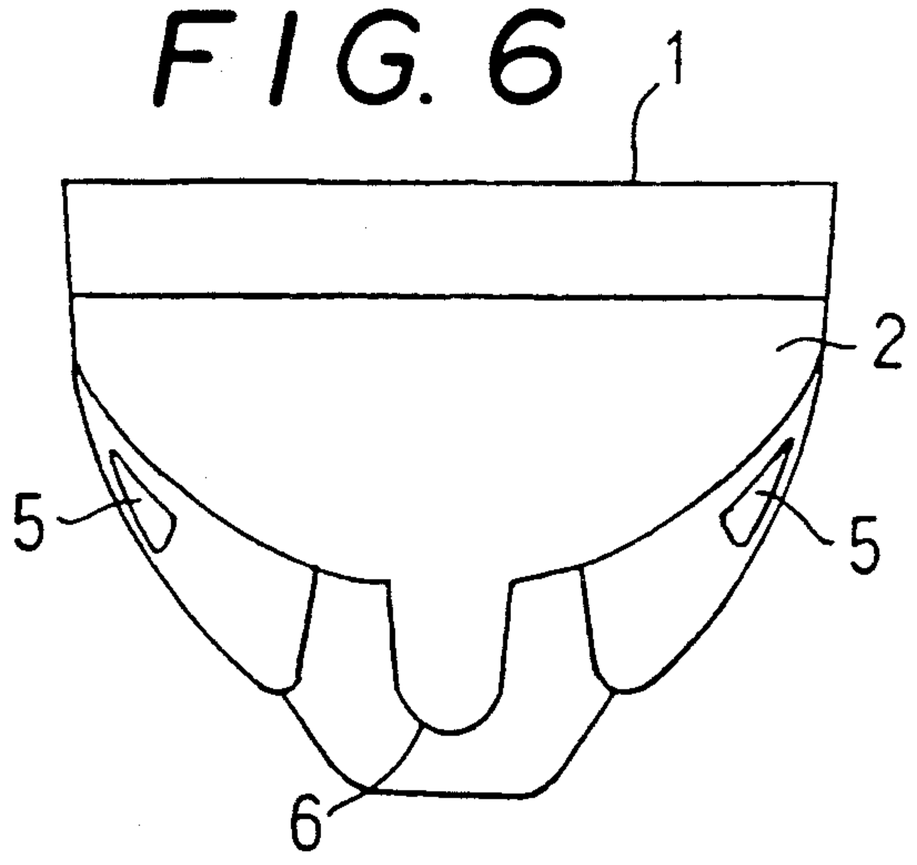

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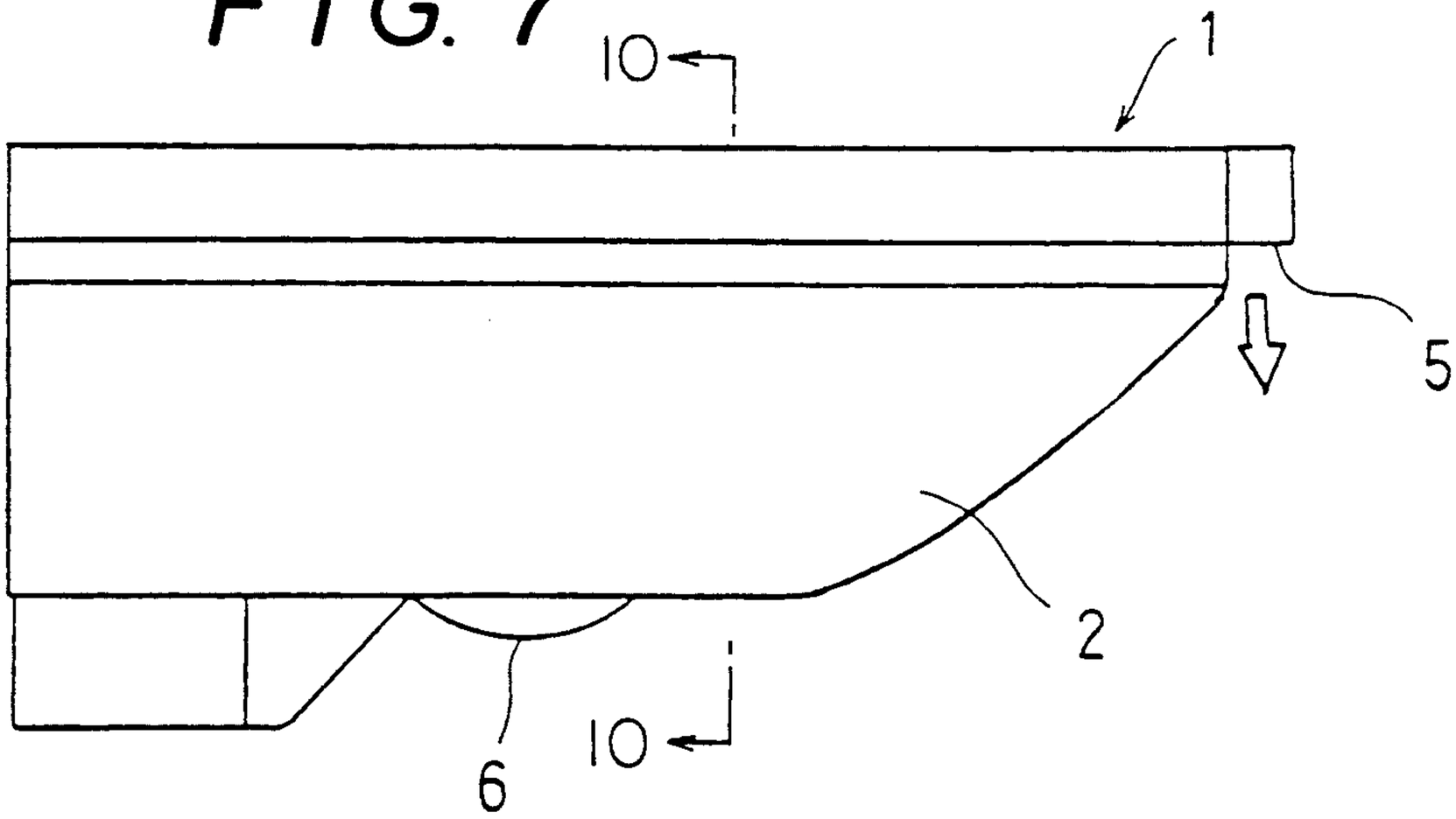
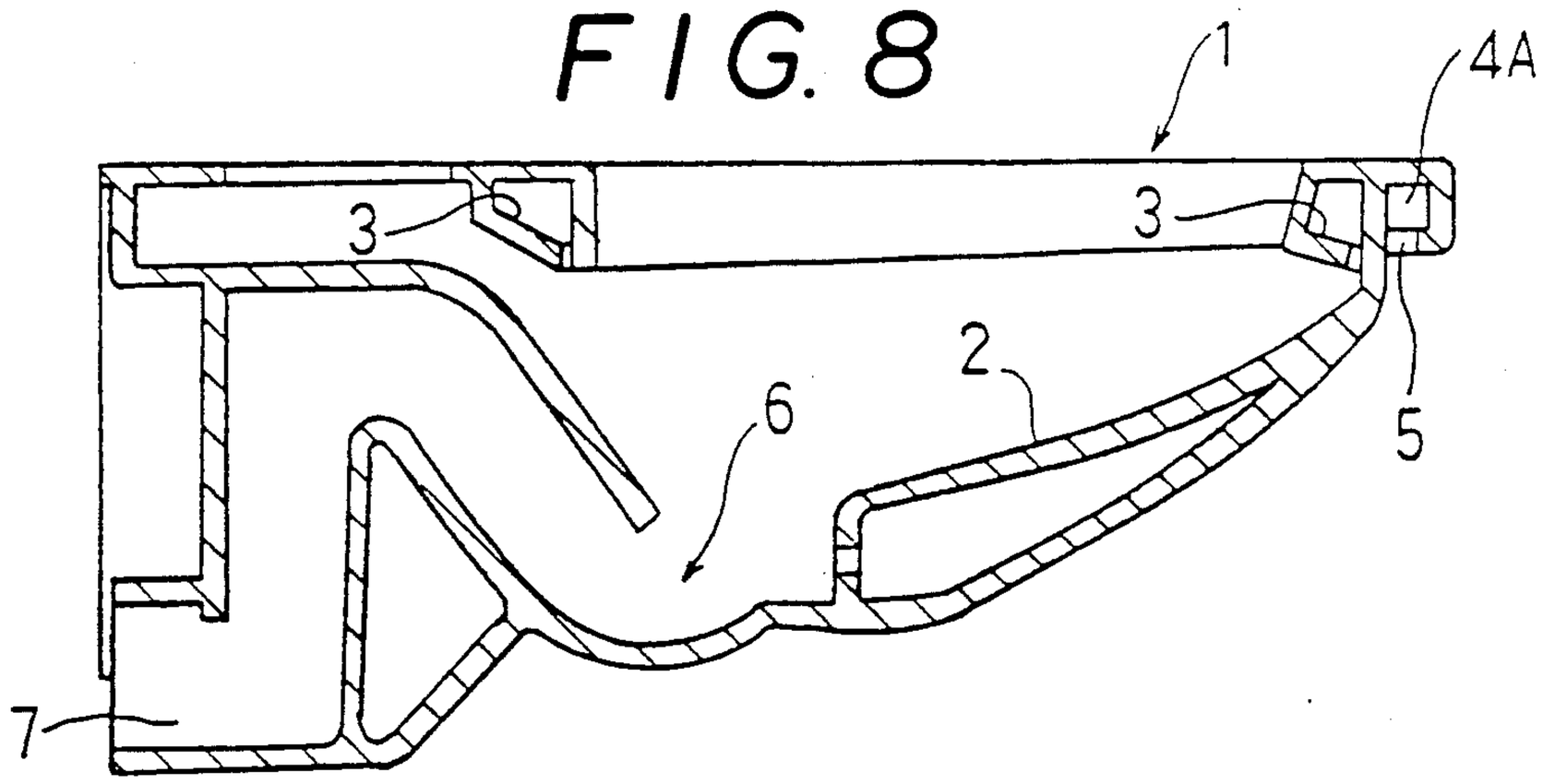


FIG. 8



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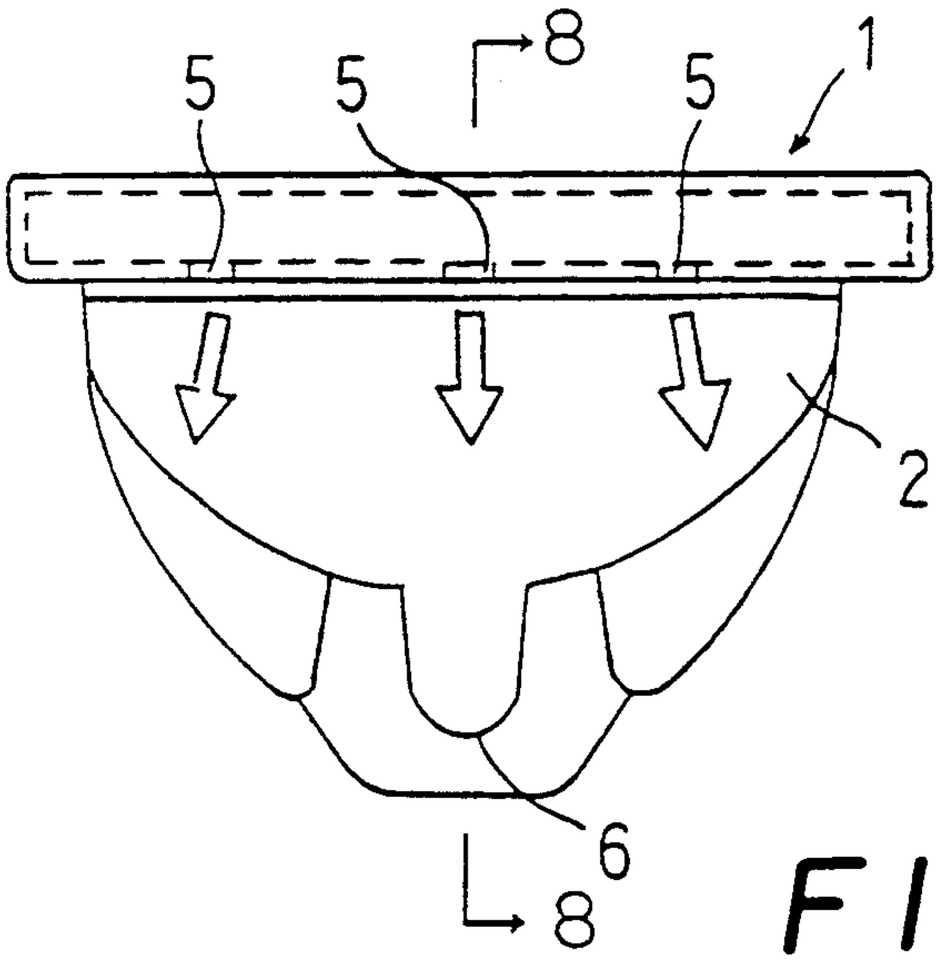

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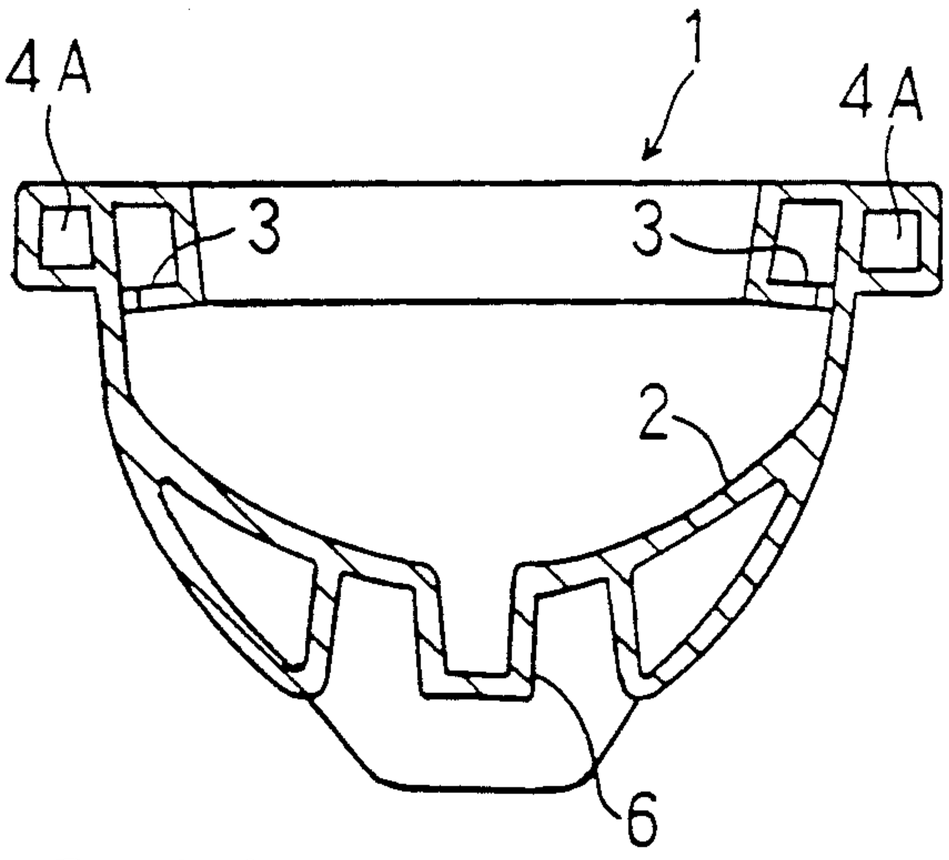

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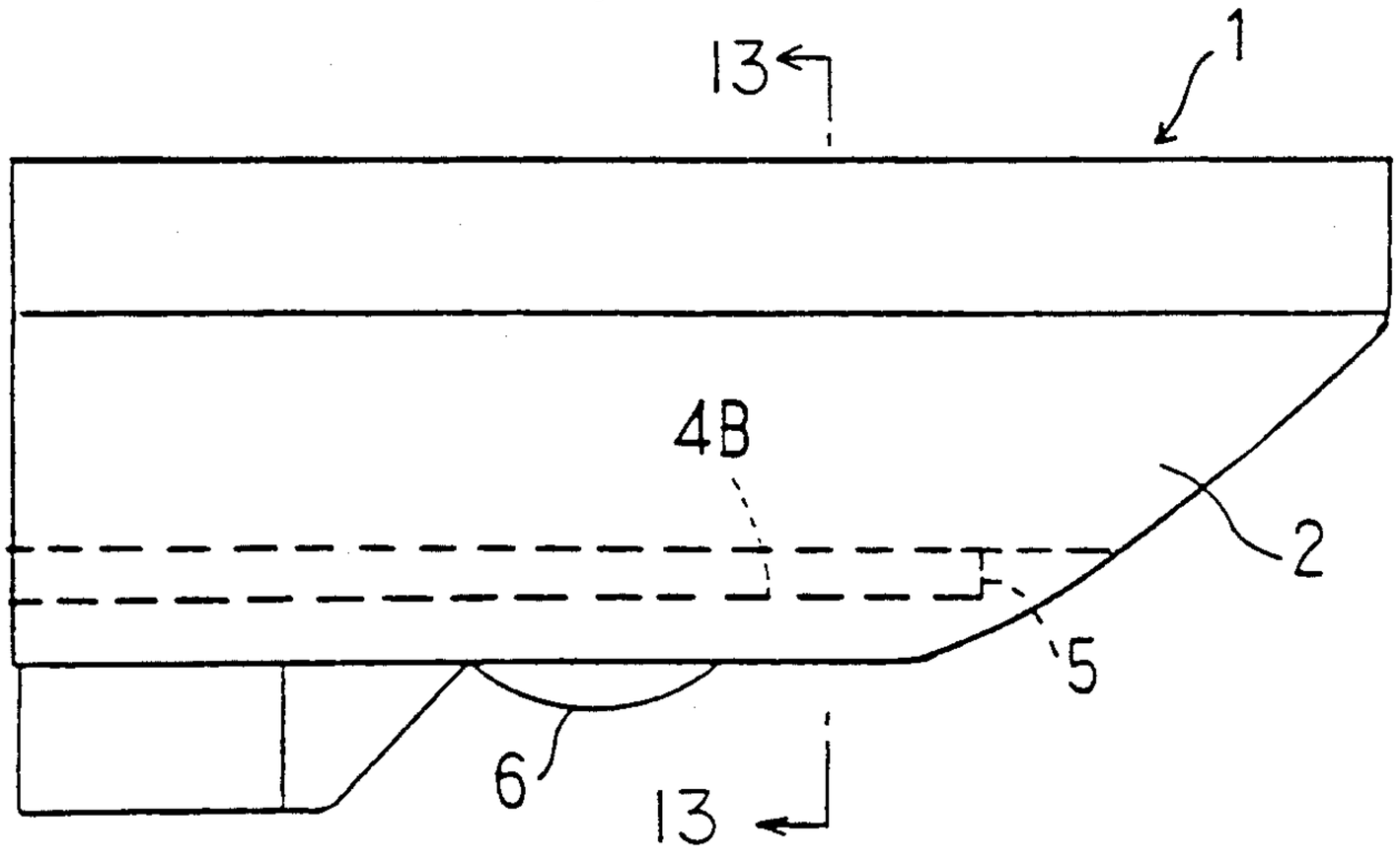

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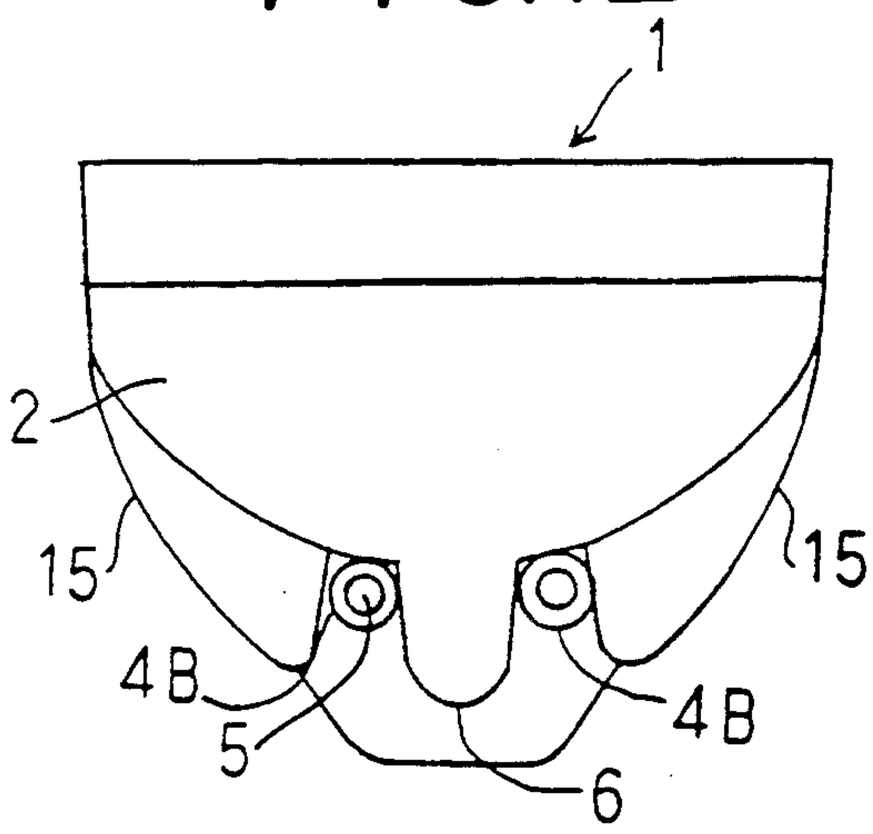
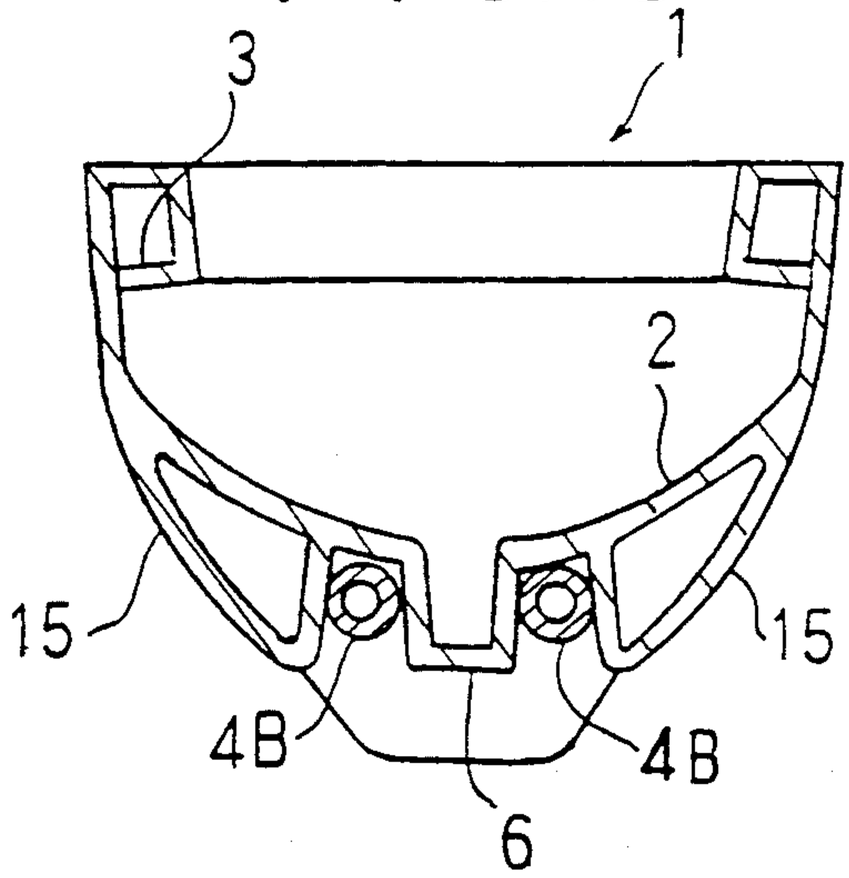


FIG. 13



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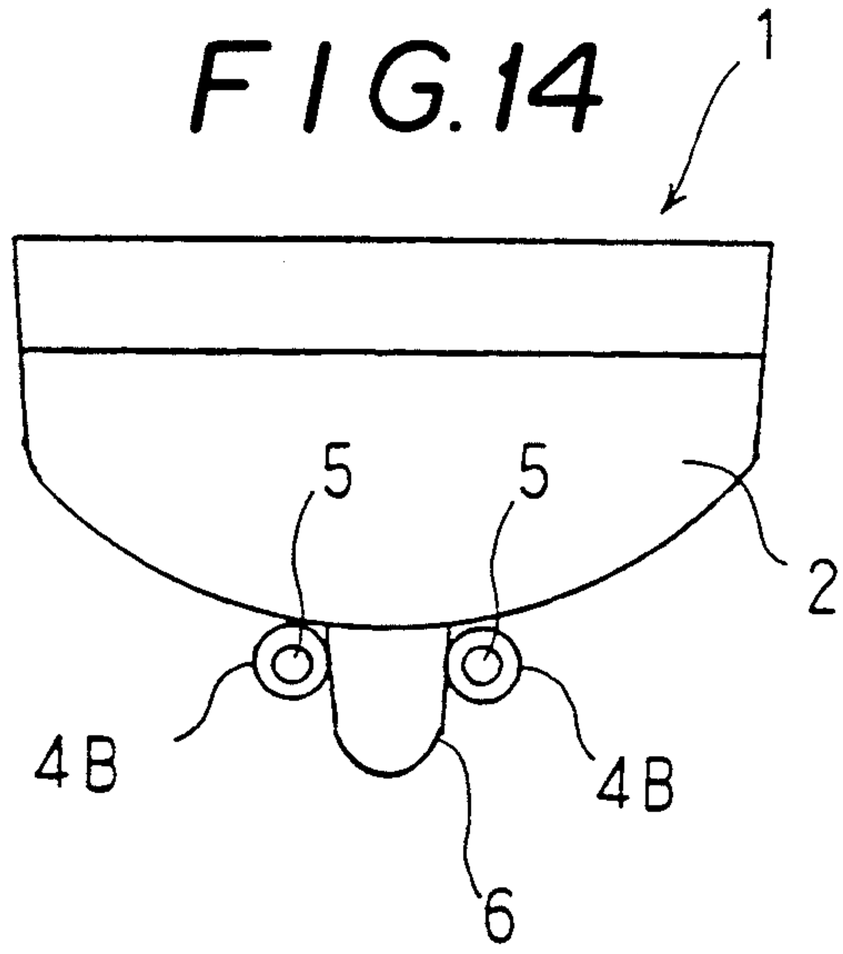

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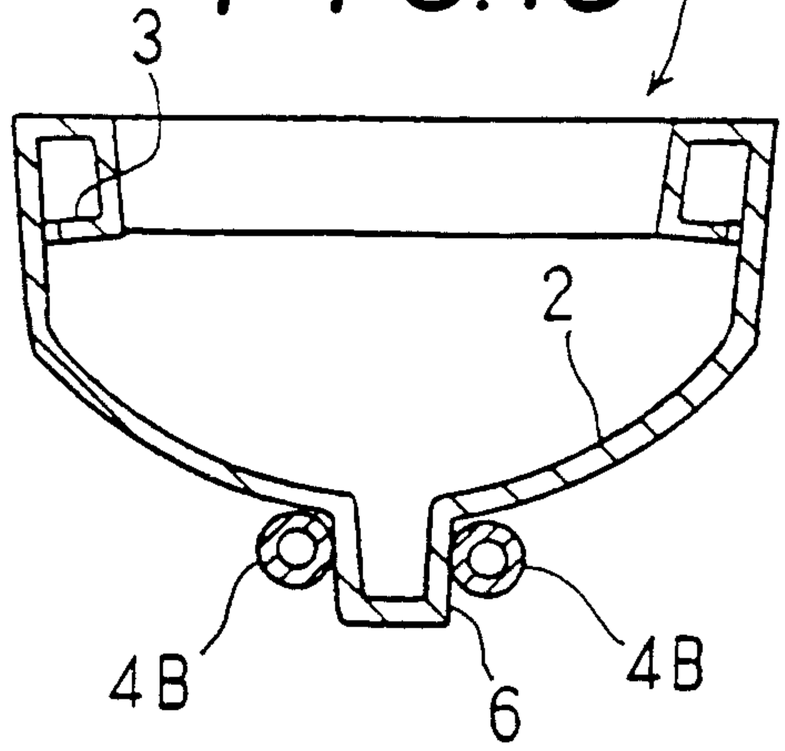

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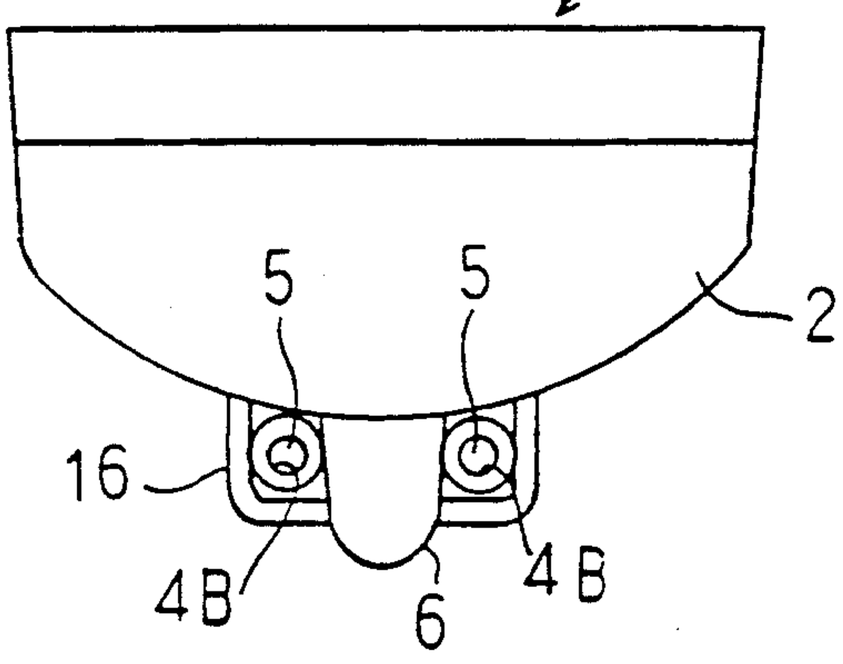
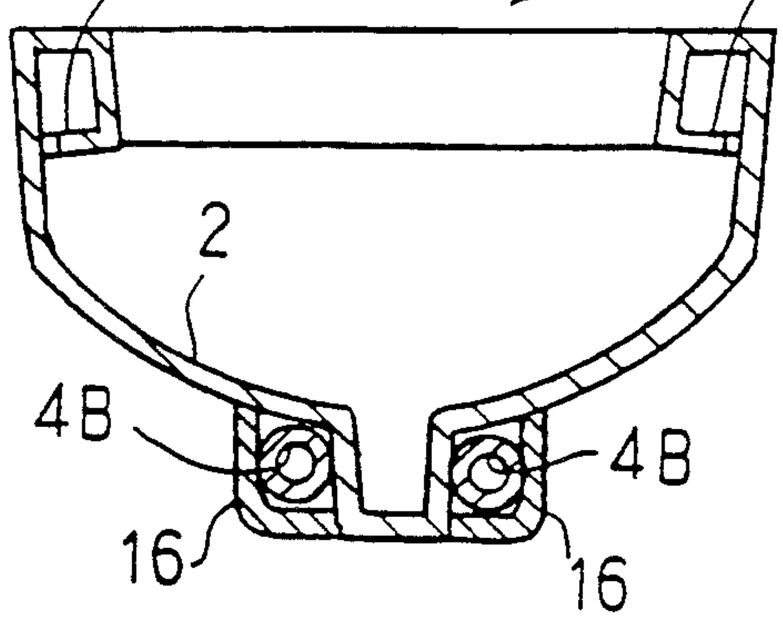


FIG. 17



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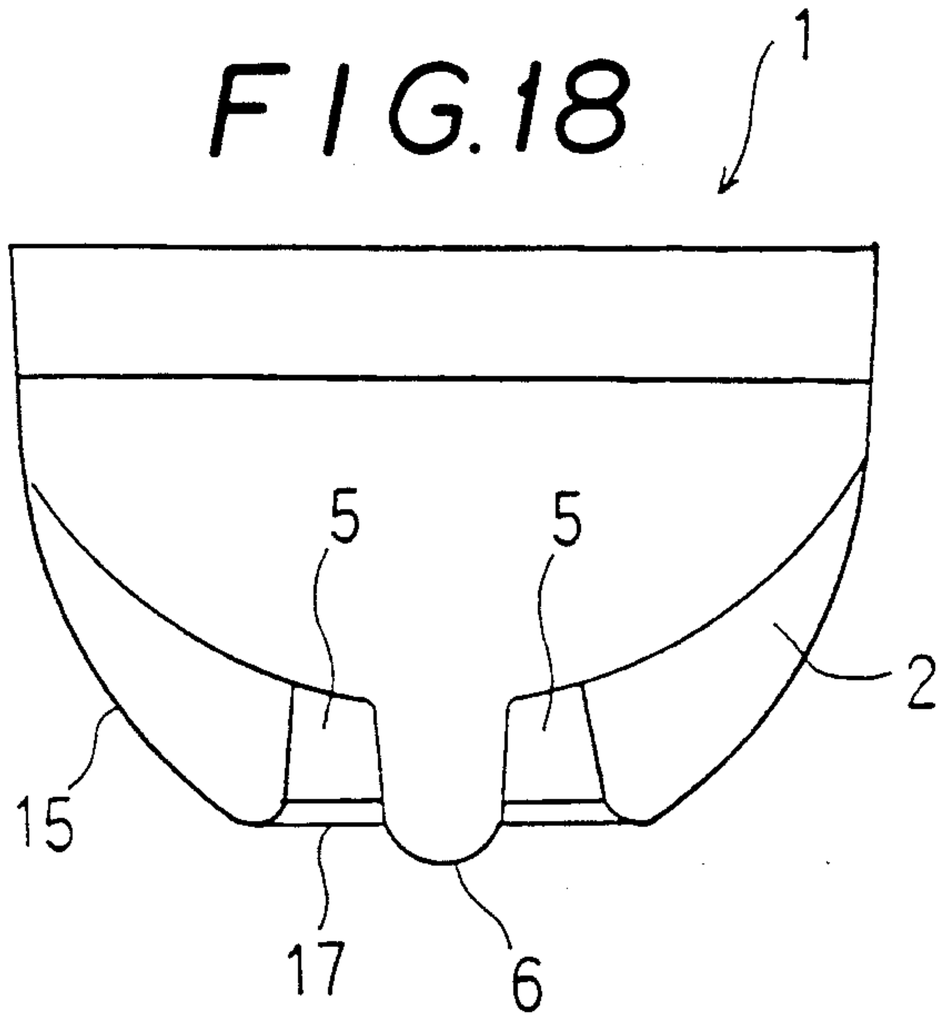


FIG.19

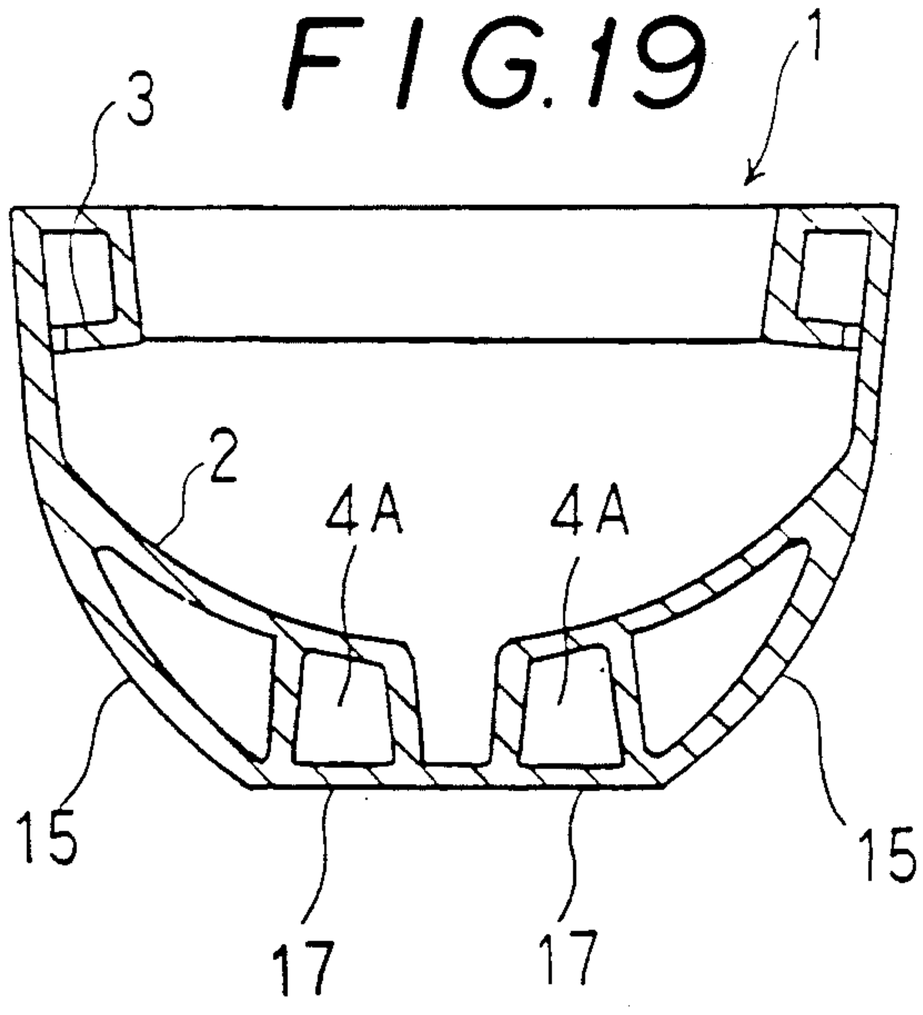


FIG.20

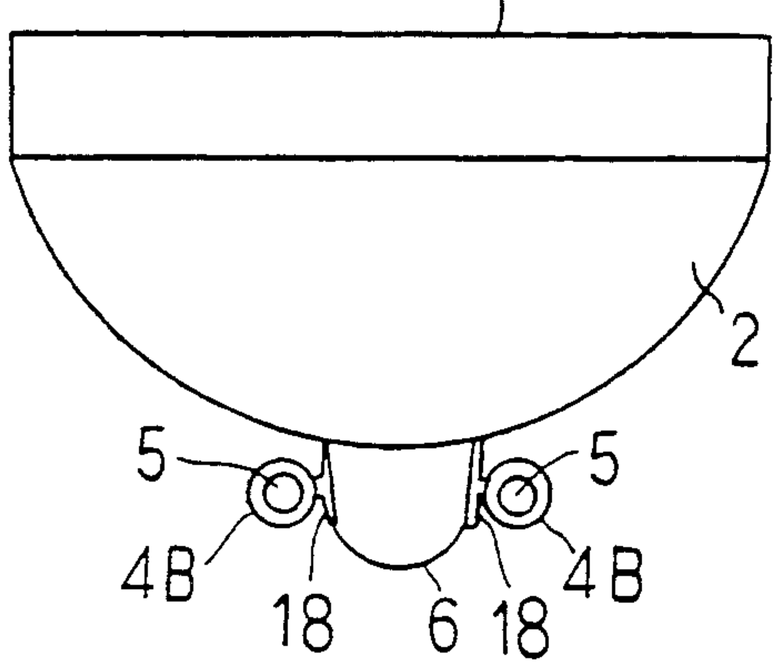
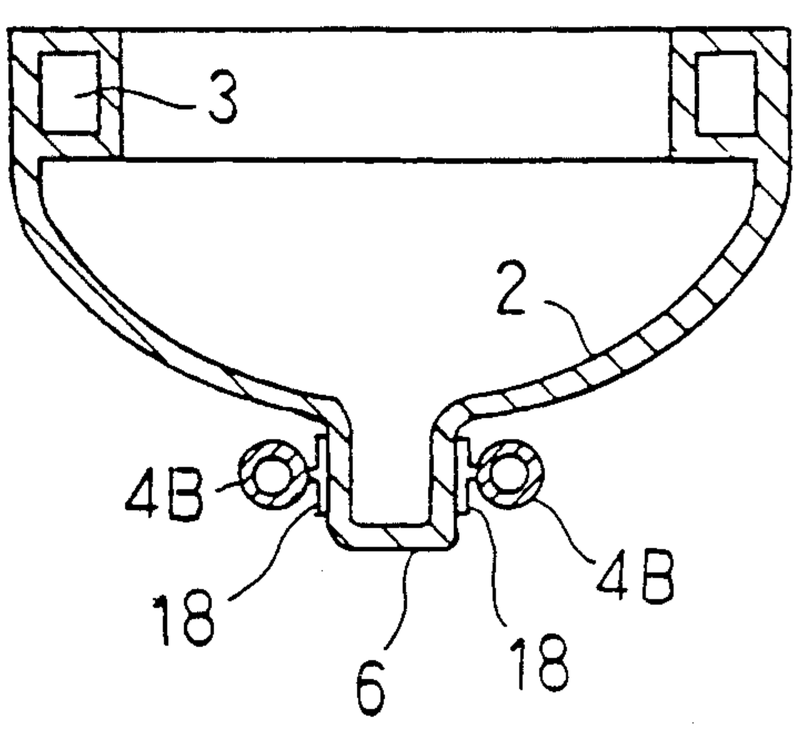


FIG.21



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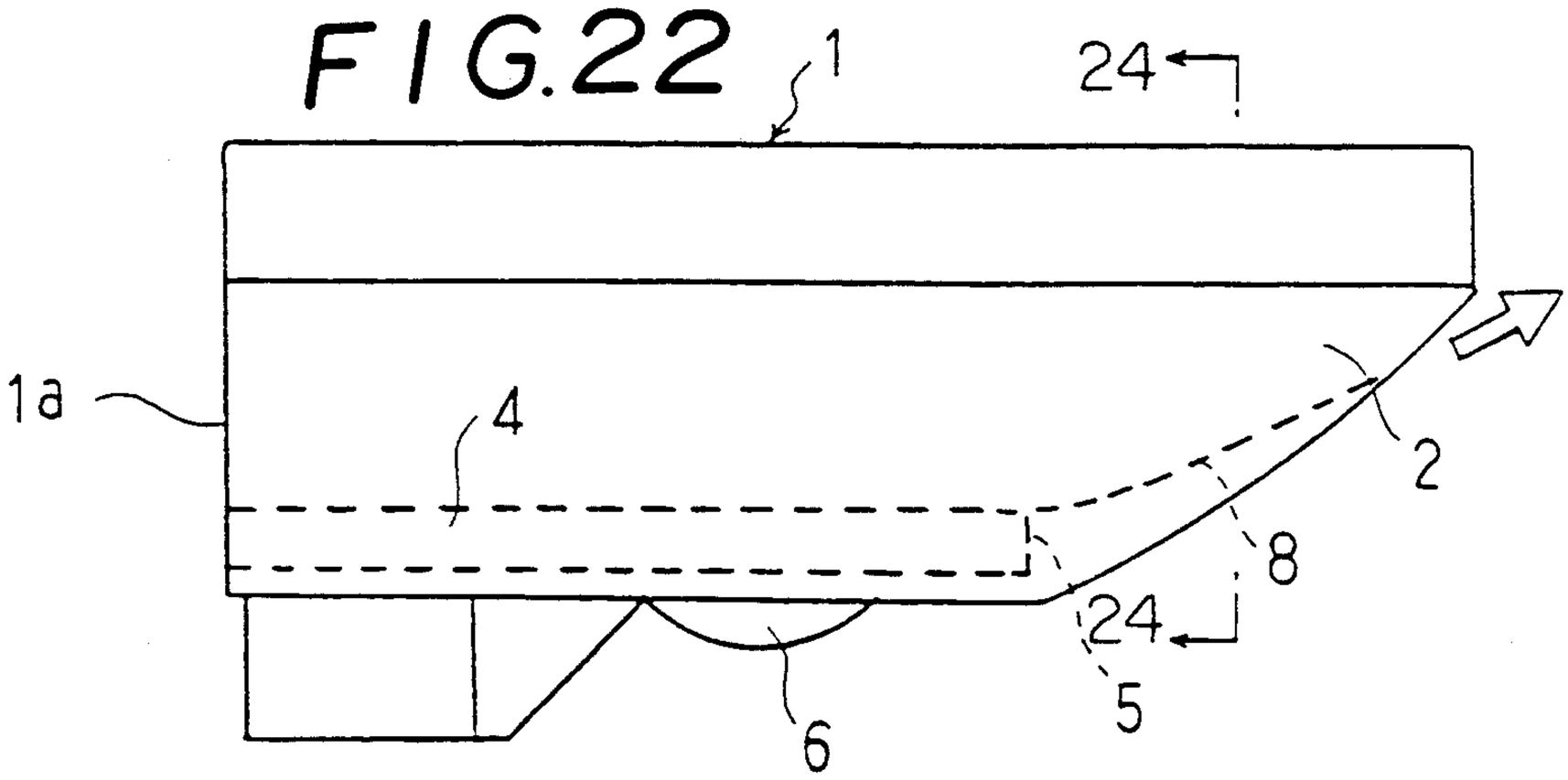

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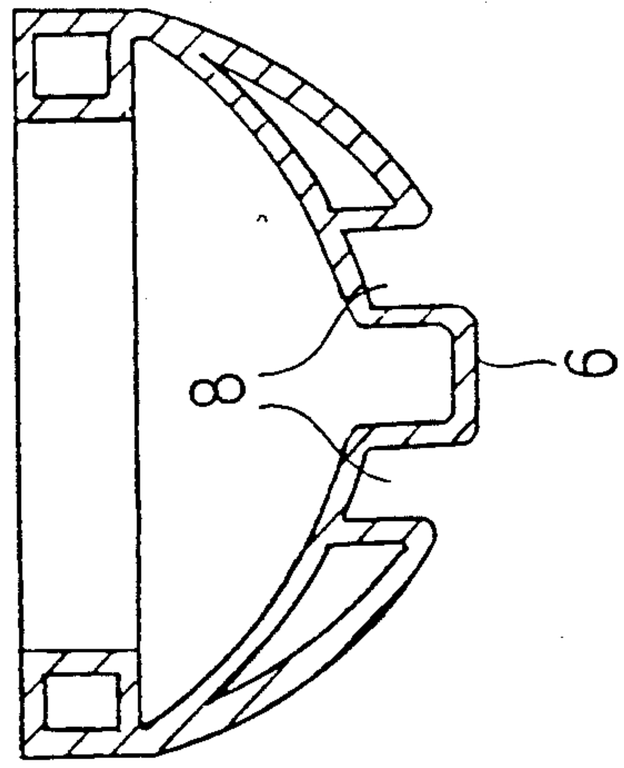

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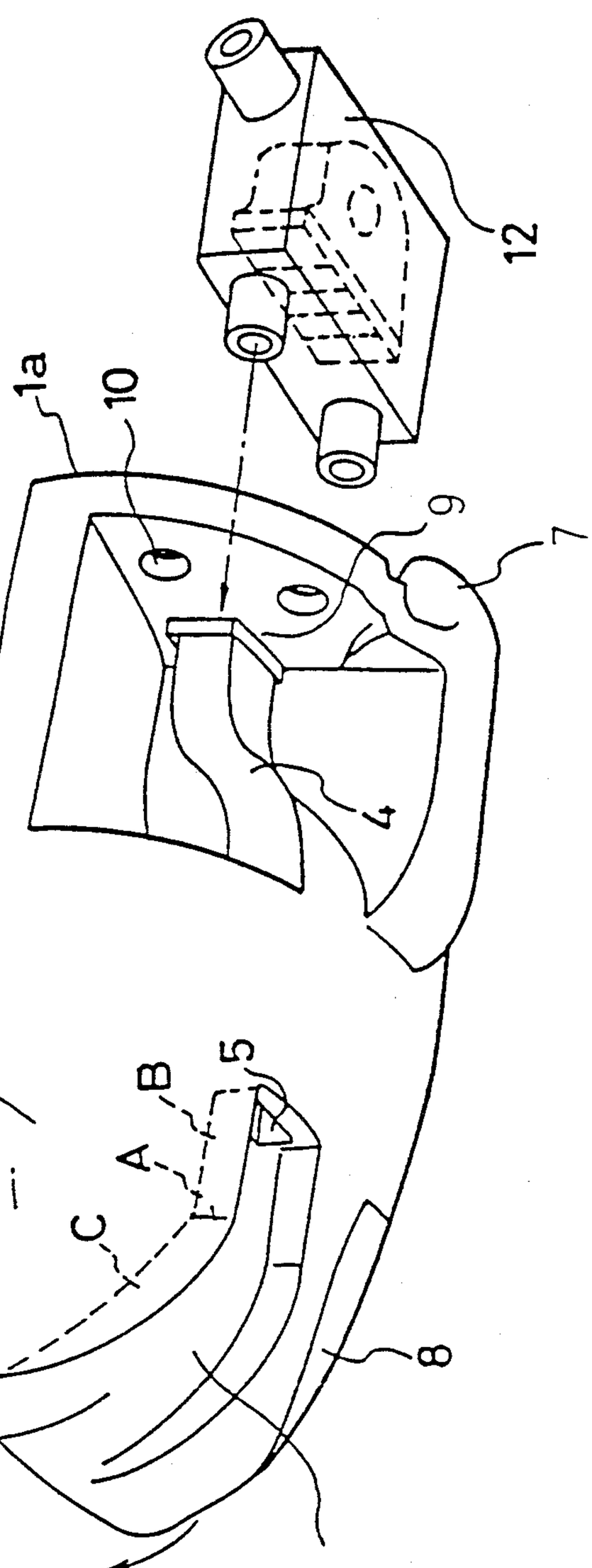

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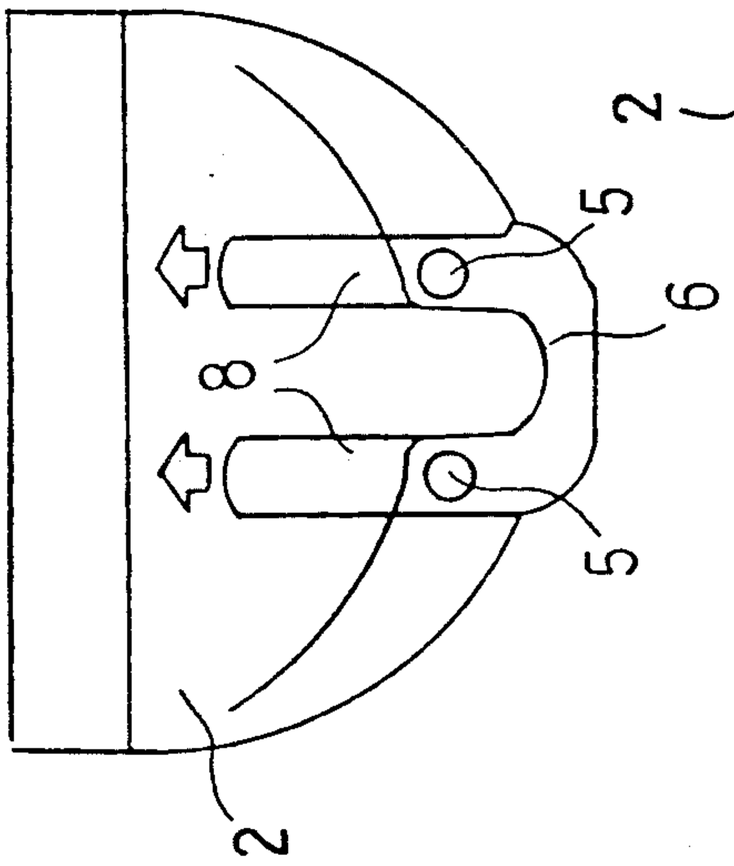

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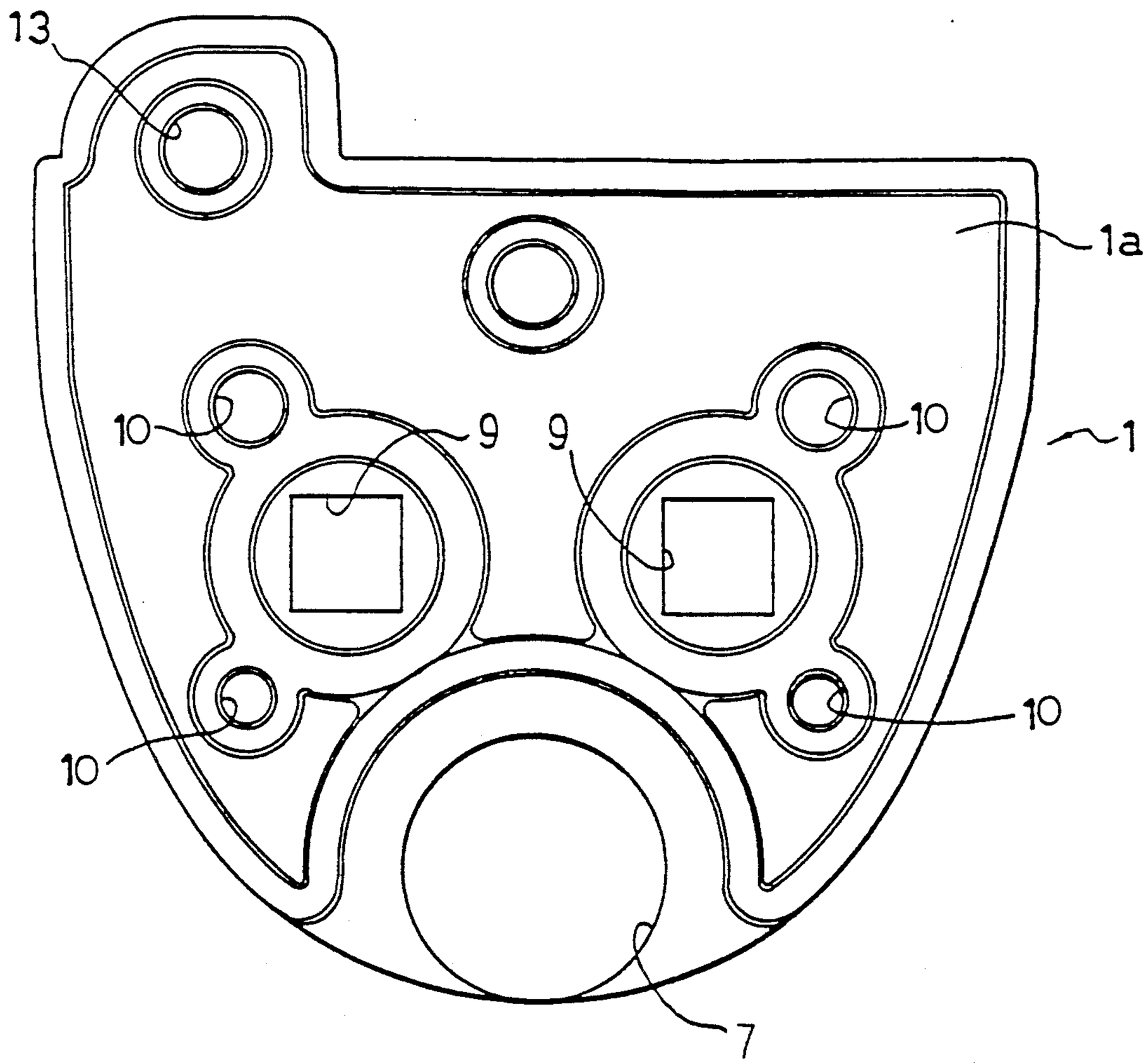

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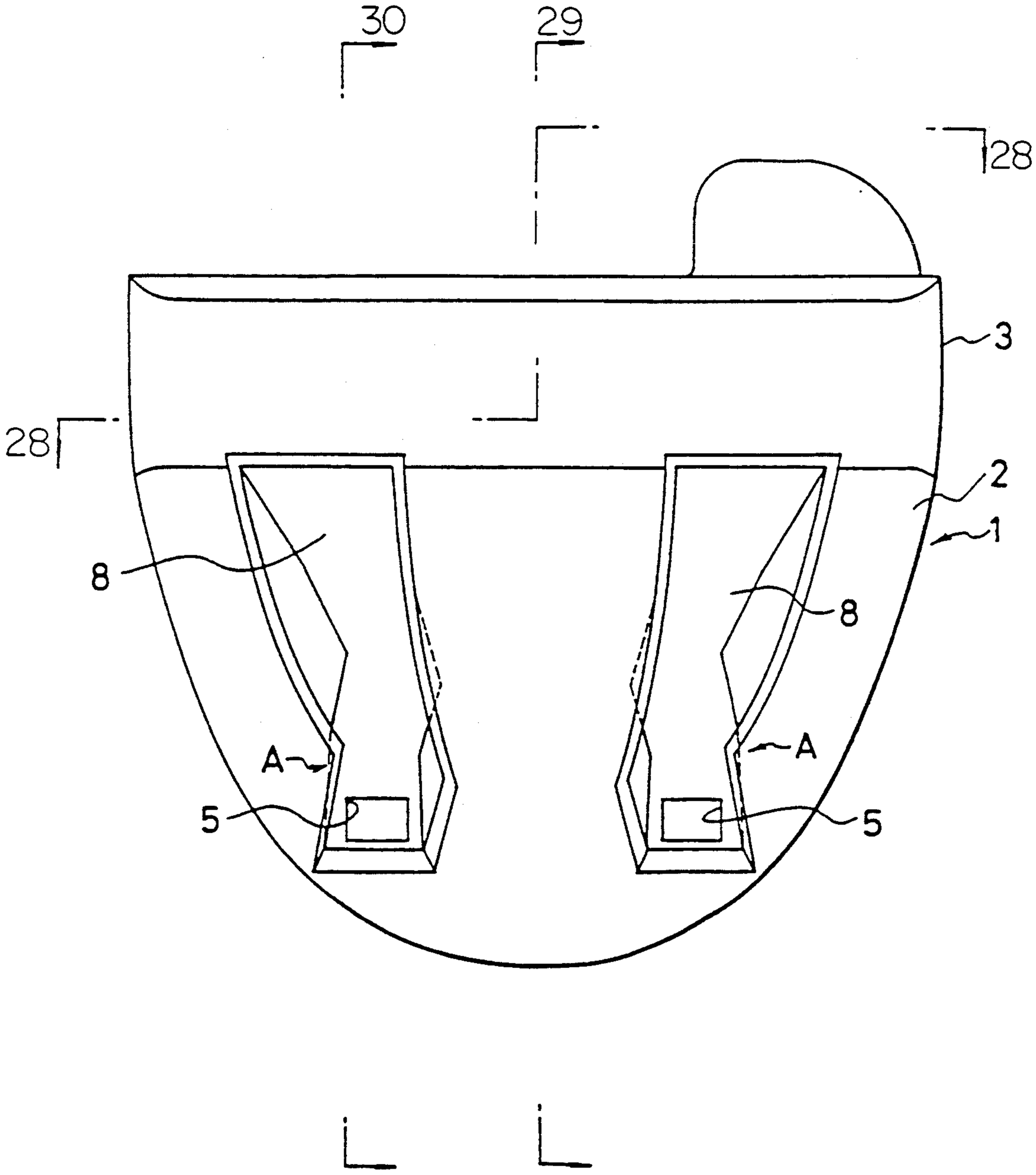

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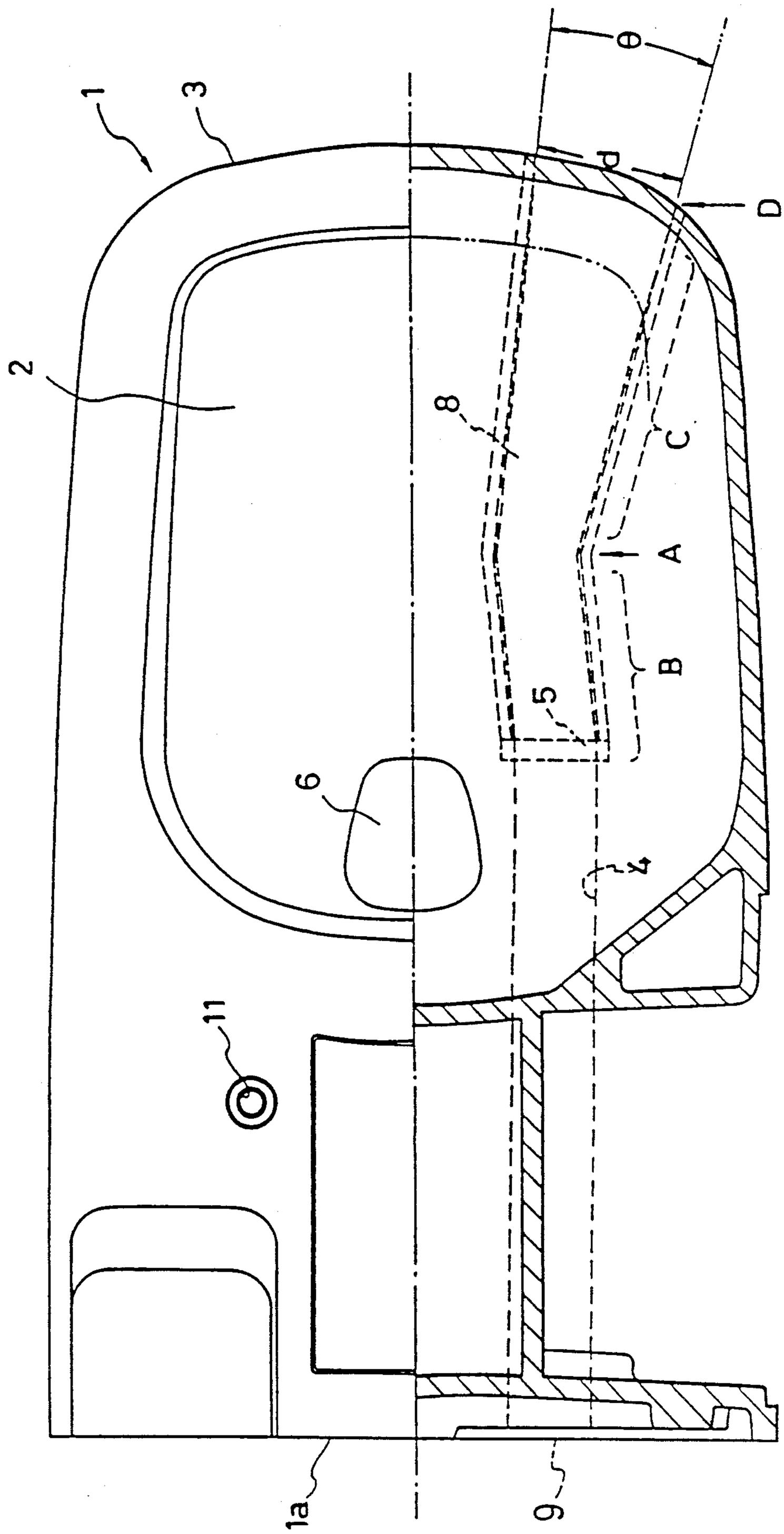


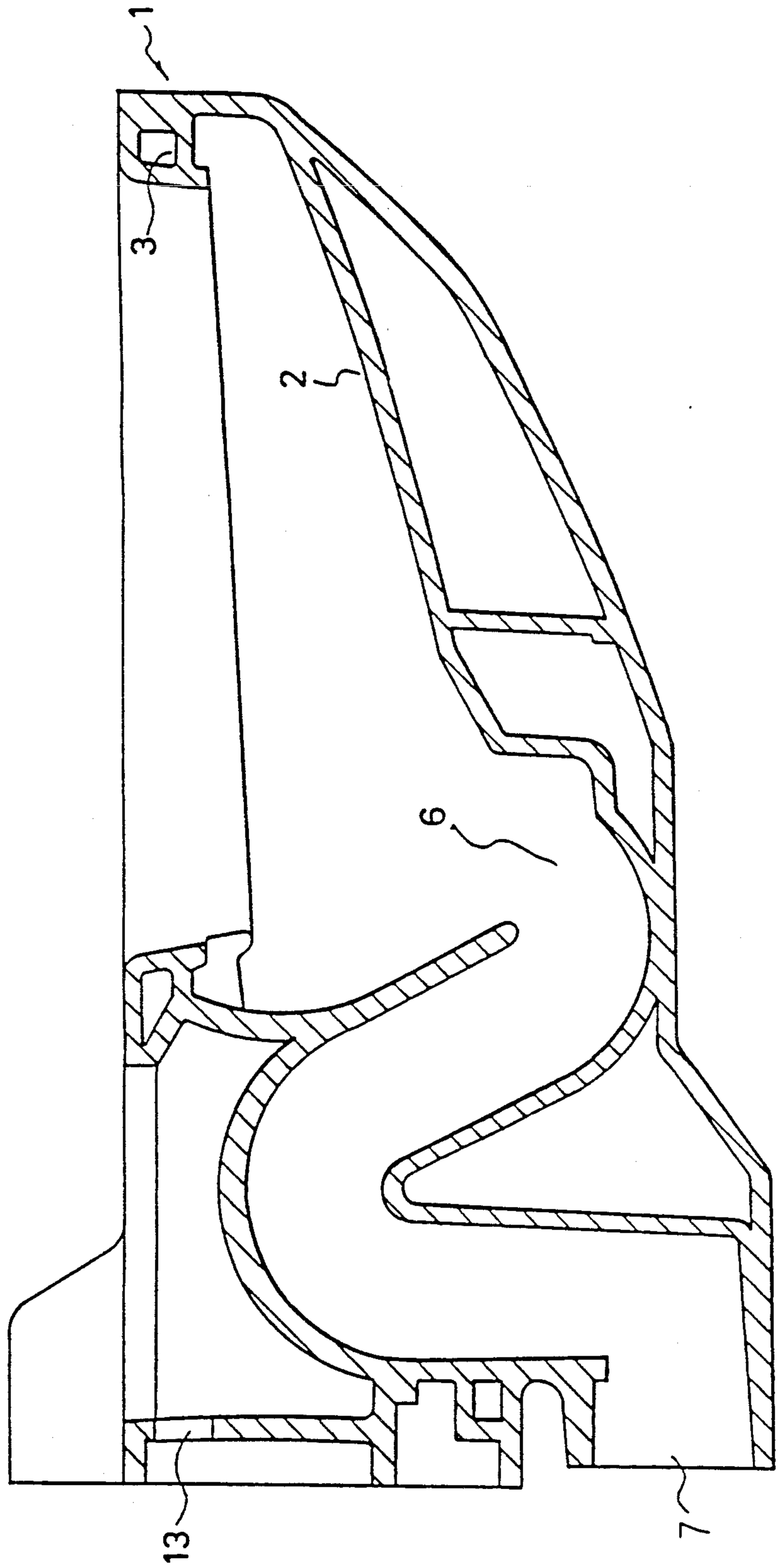


FIG.29

FIG.30

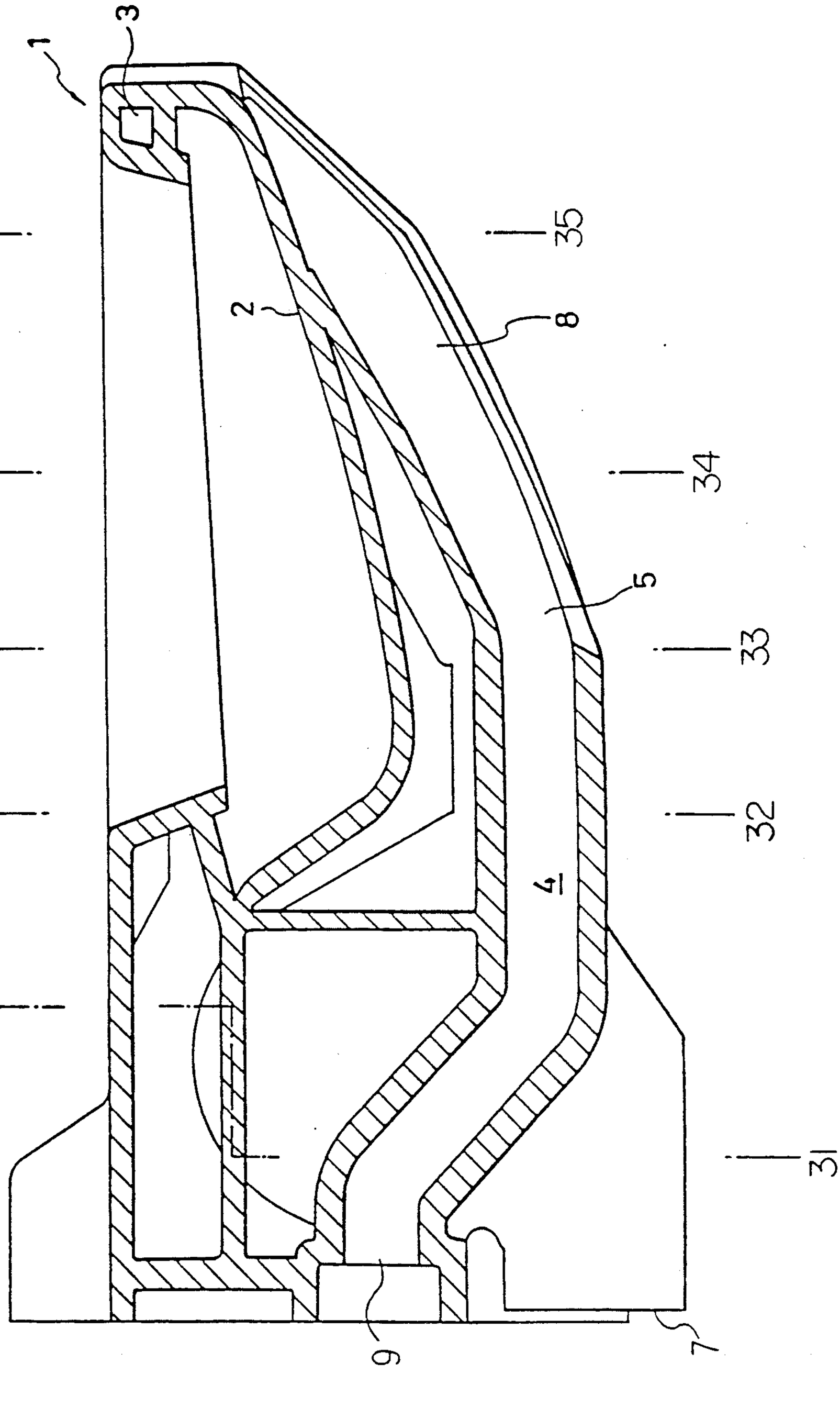


FIG. 31

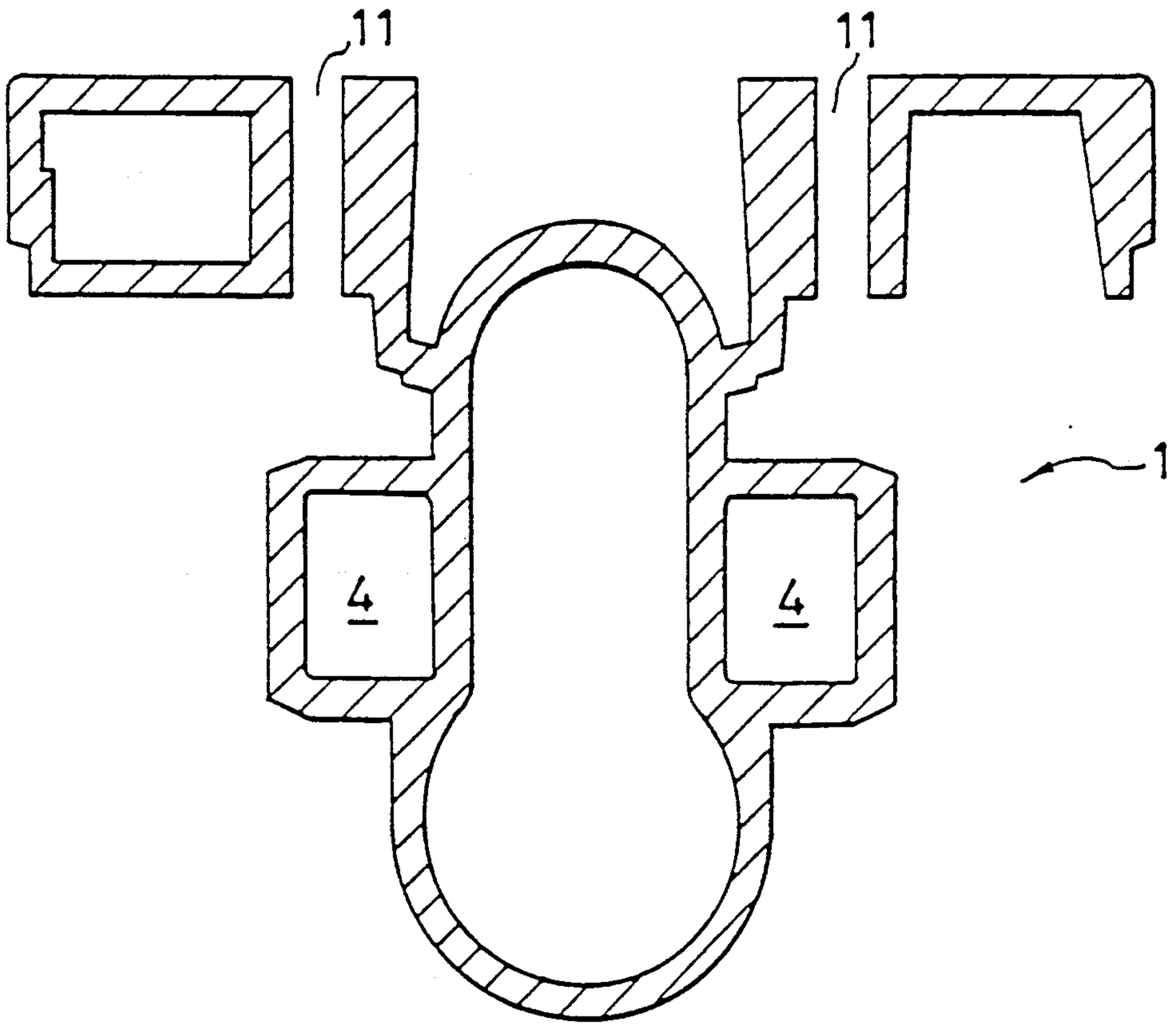


FIG. 32

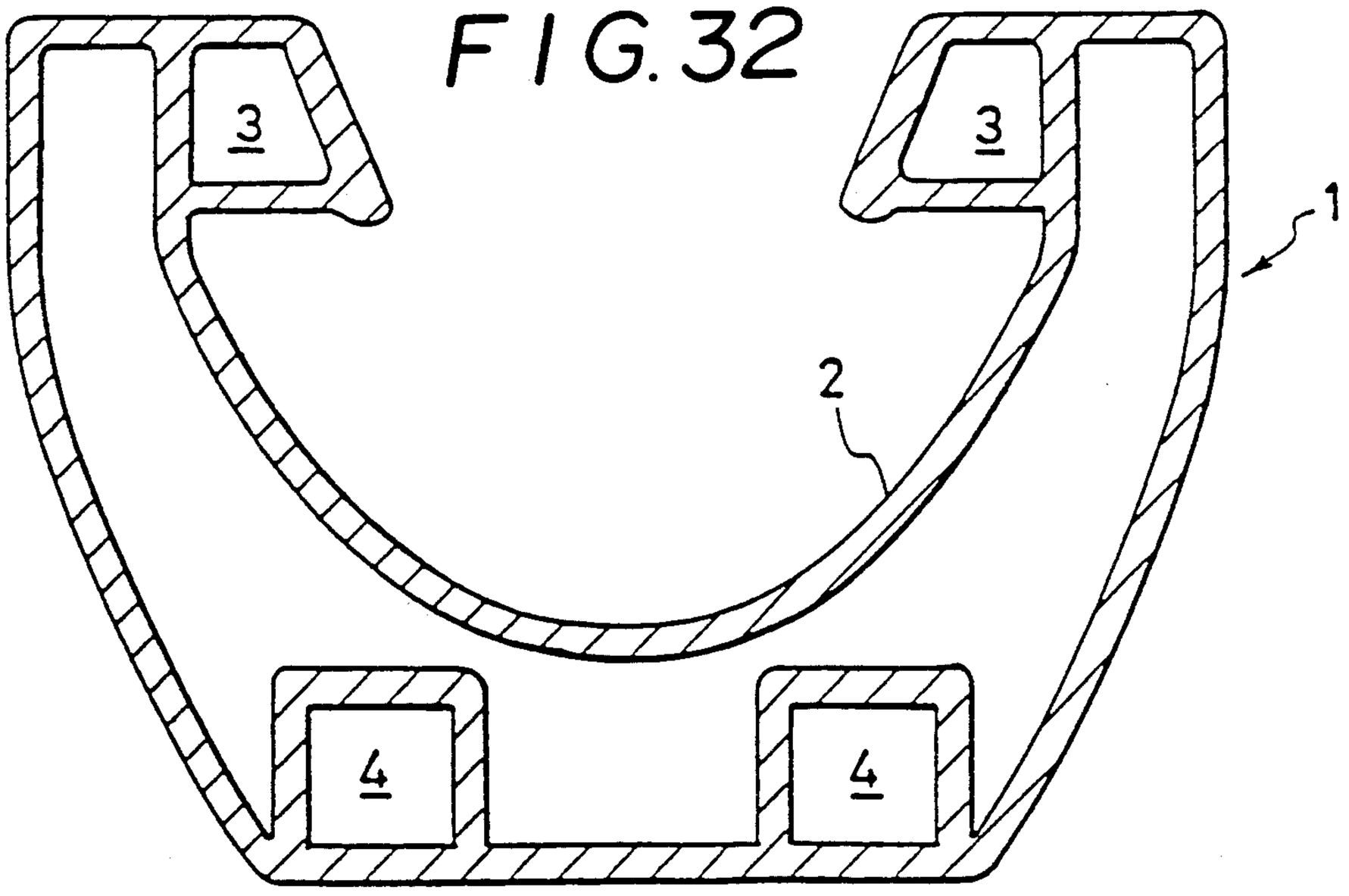
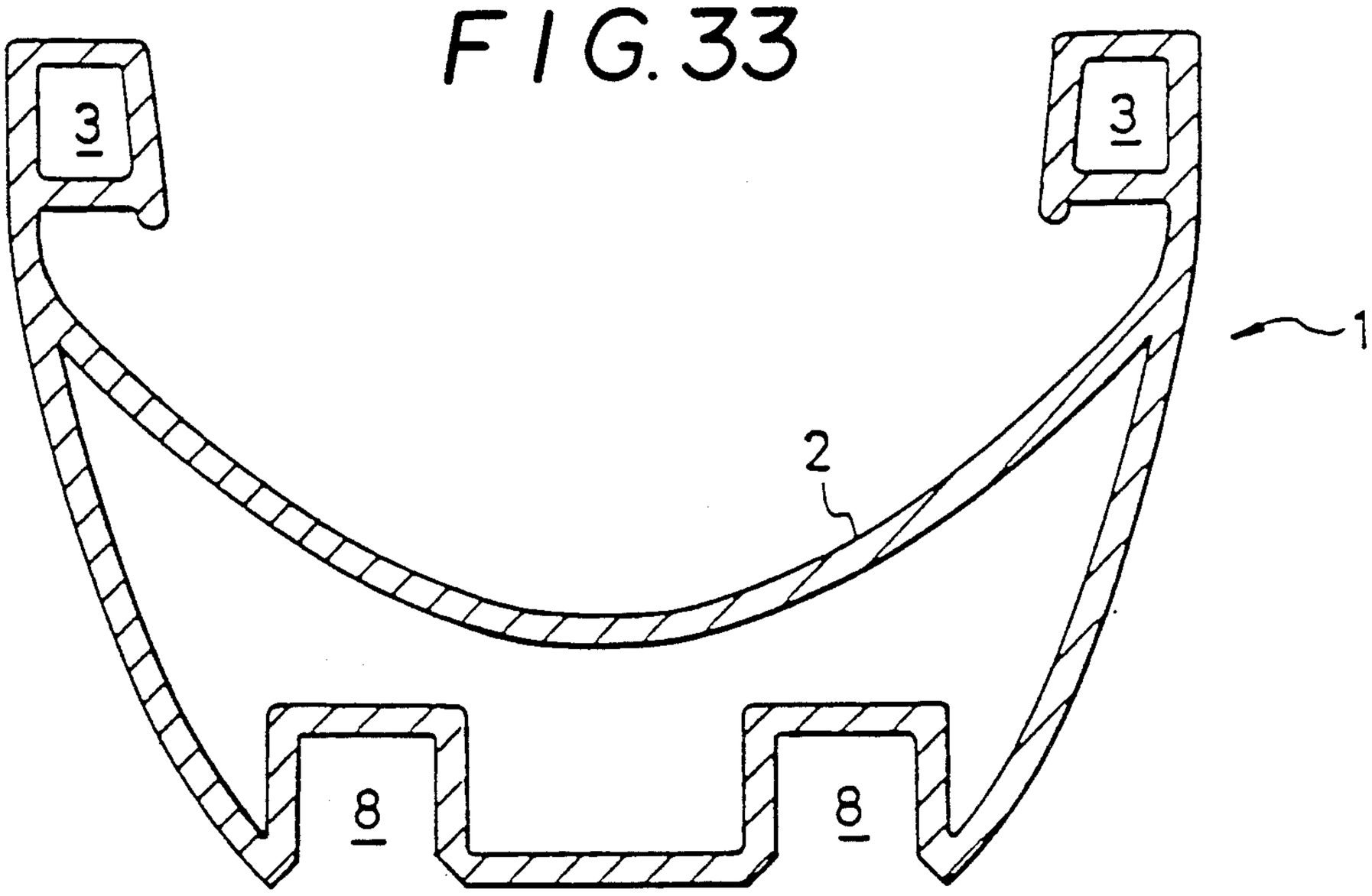


FIG. 33



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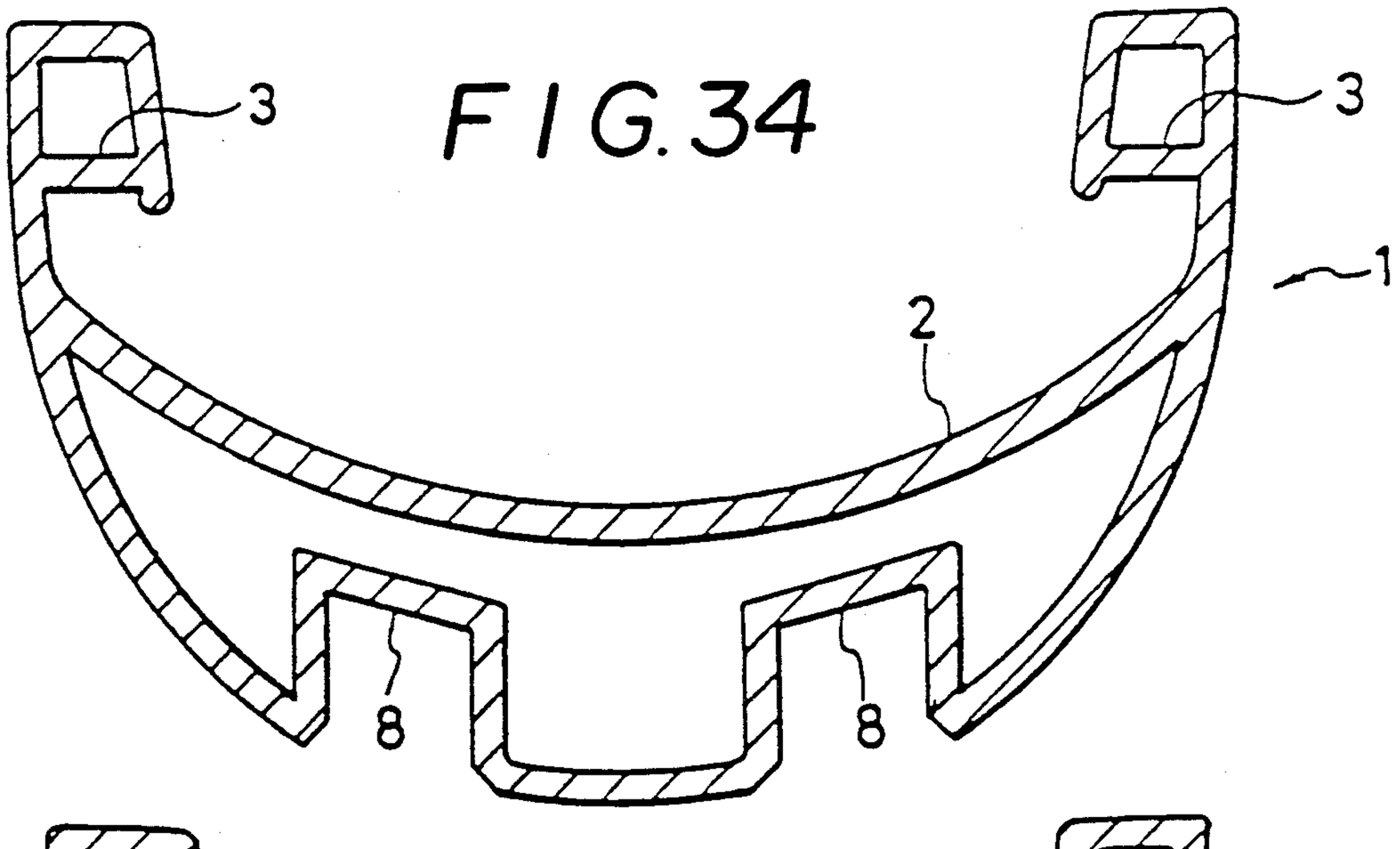

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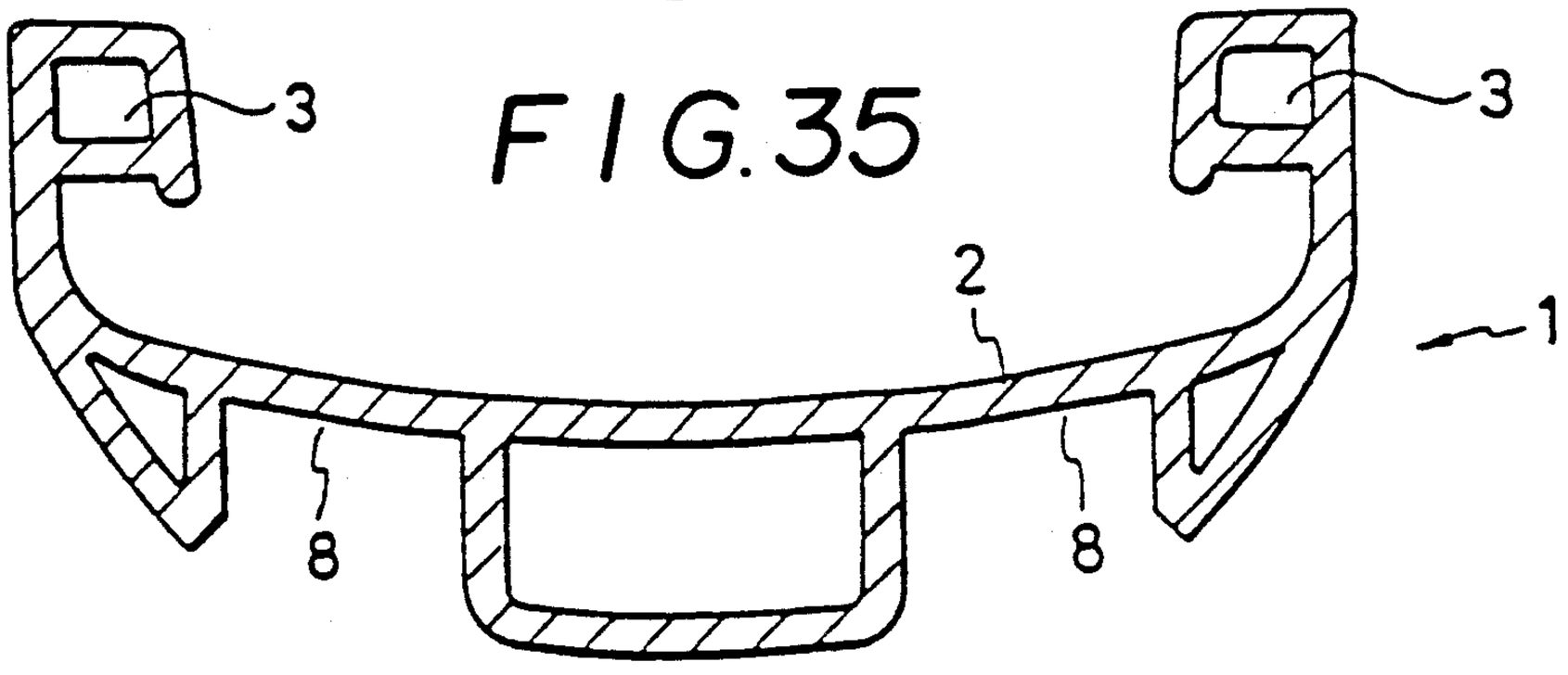

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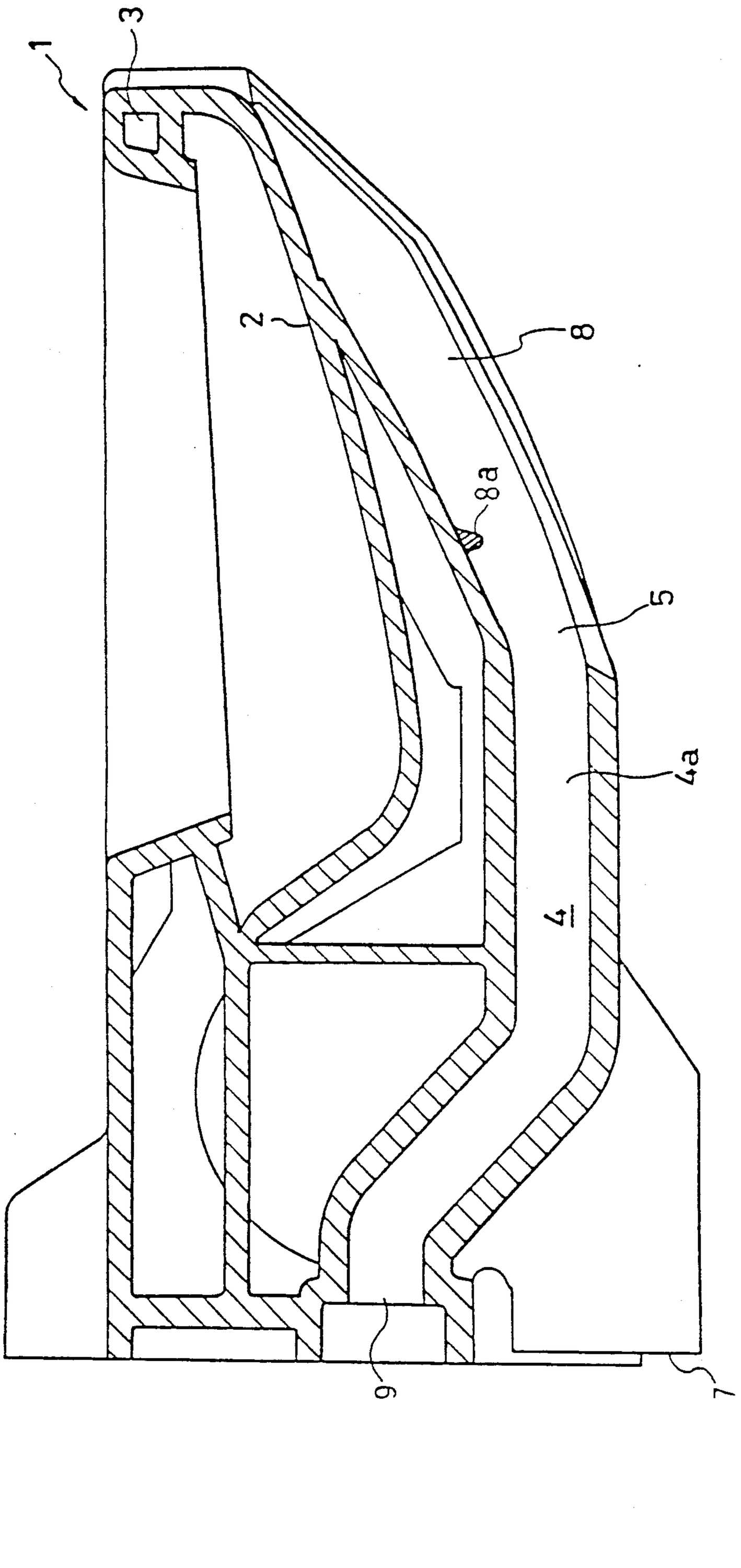

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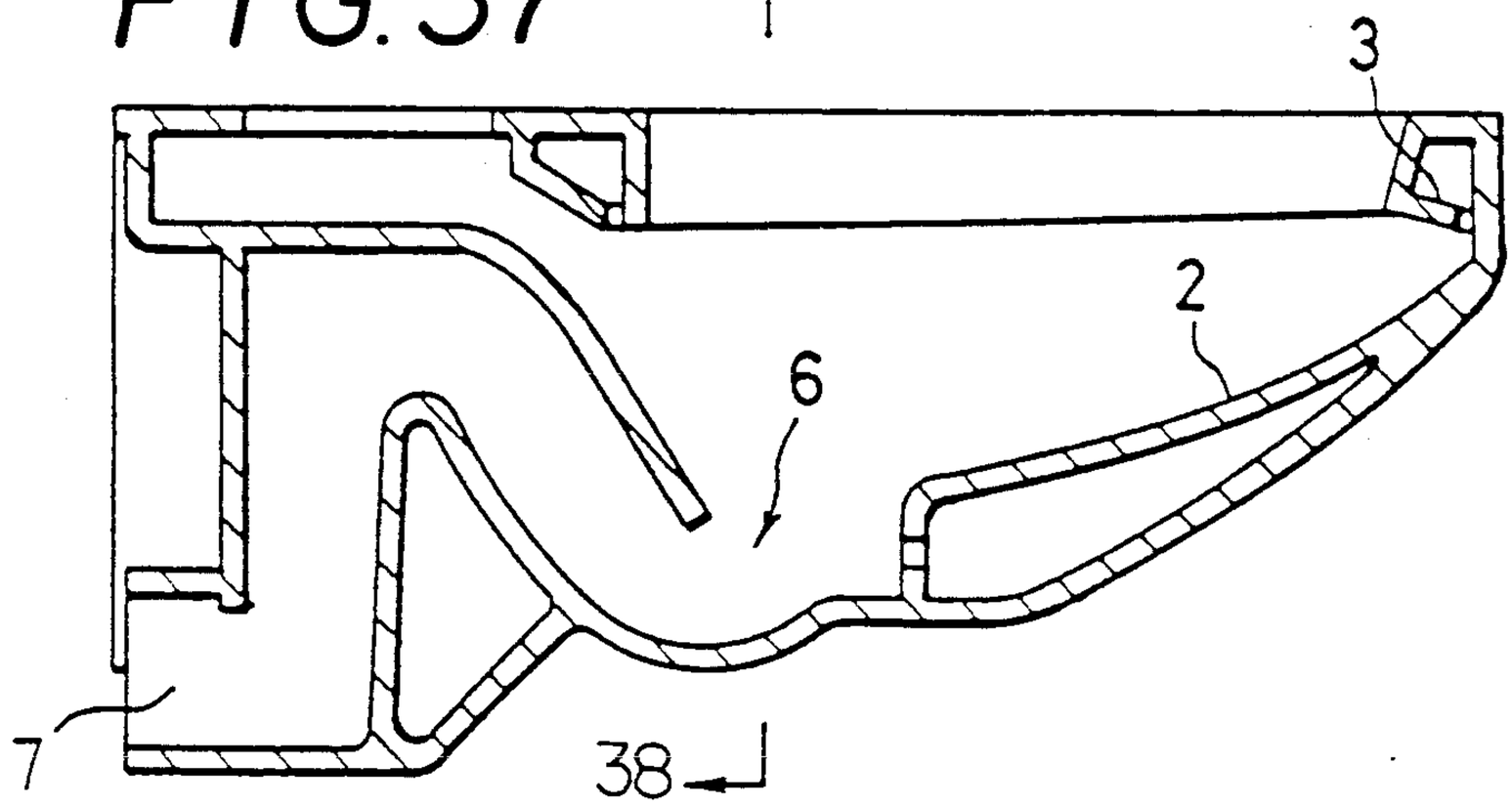

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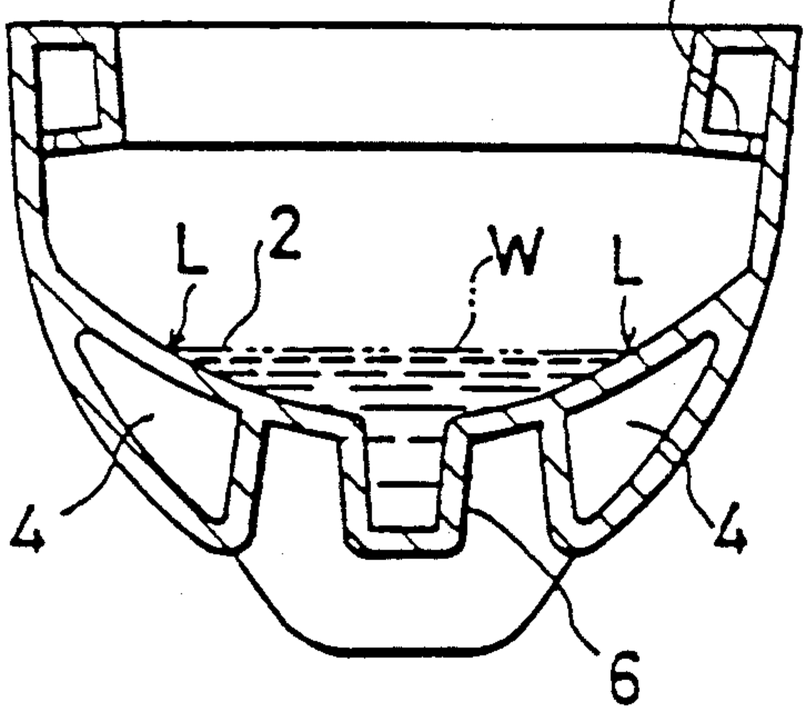
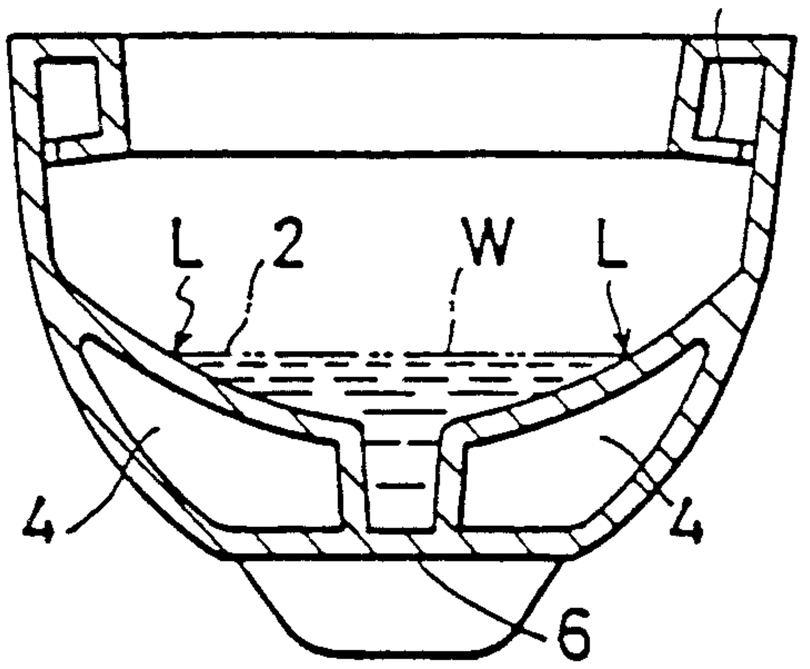


FIG. 40



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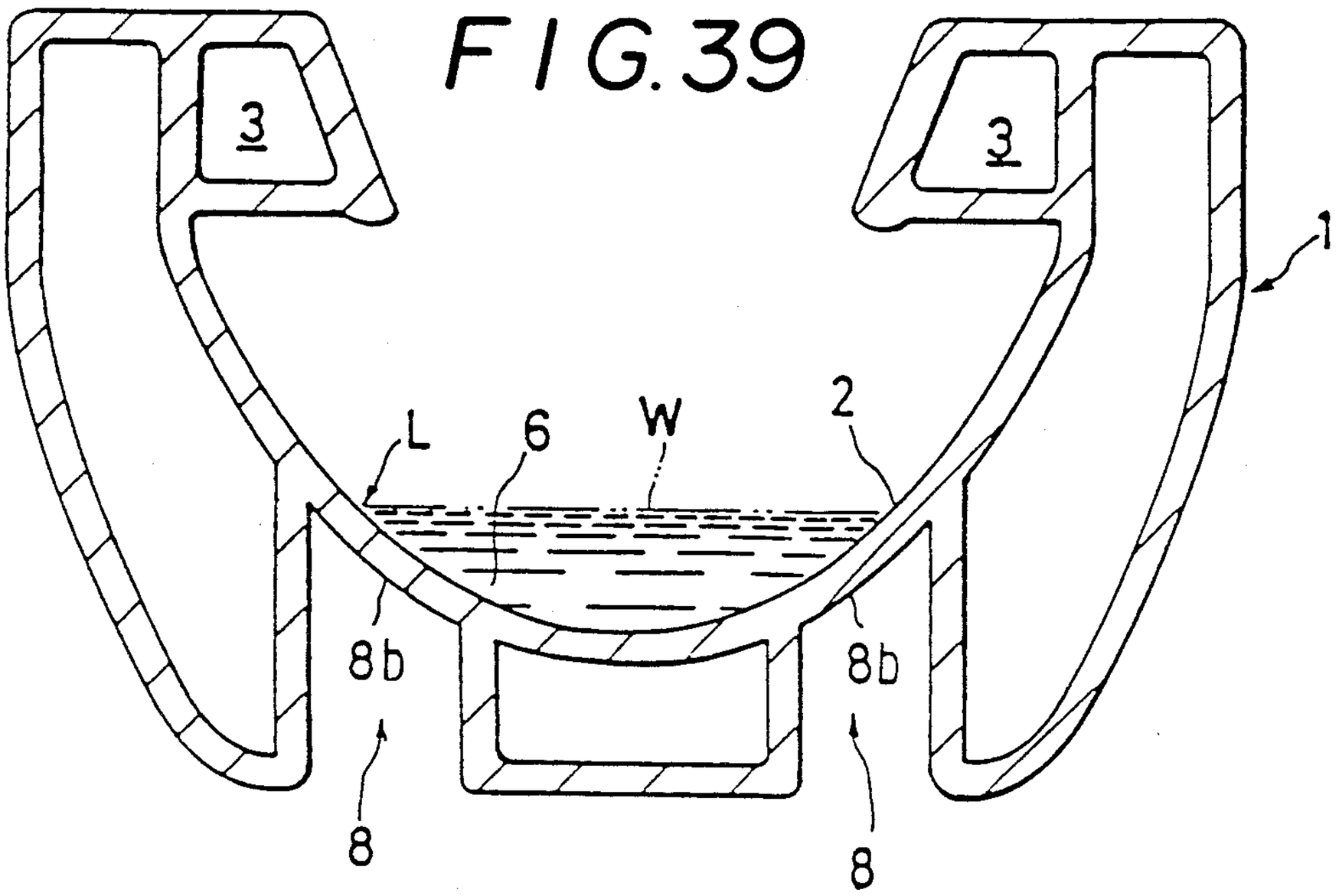

FIG. 41

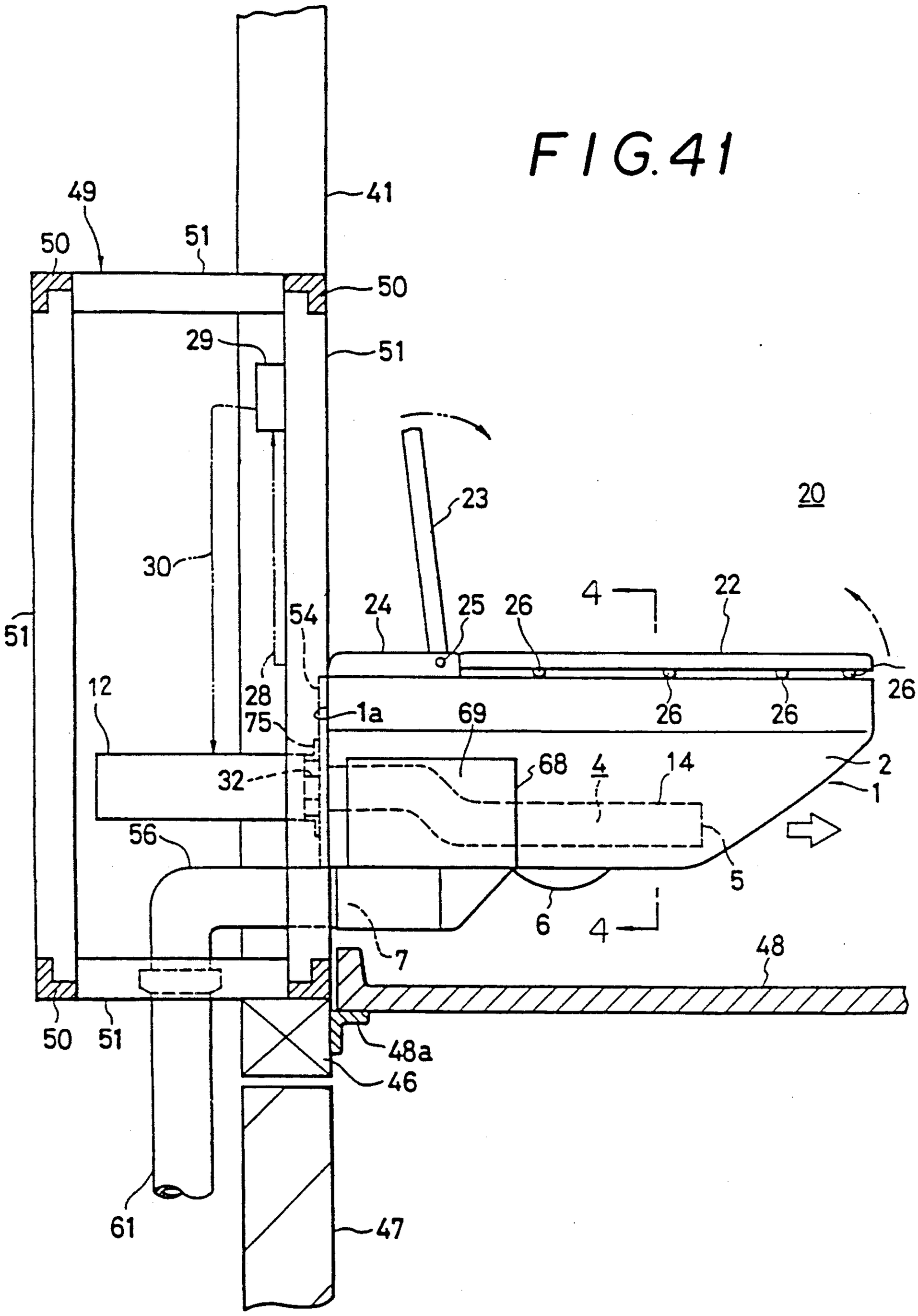
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FIG.42

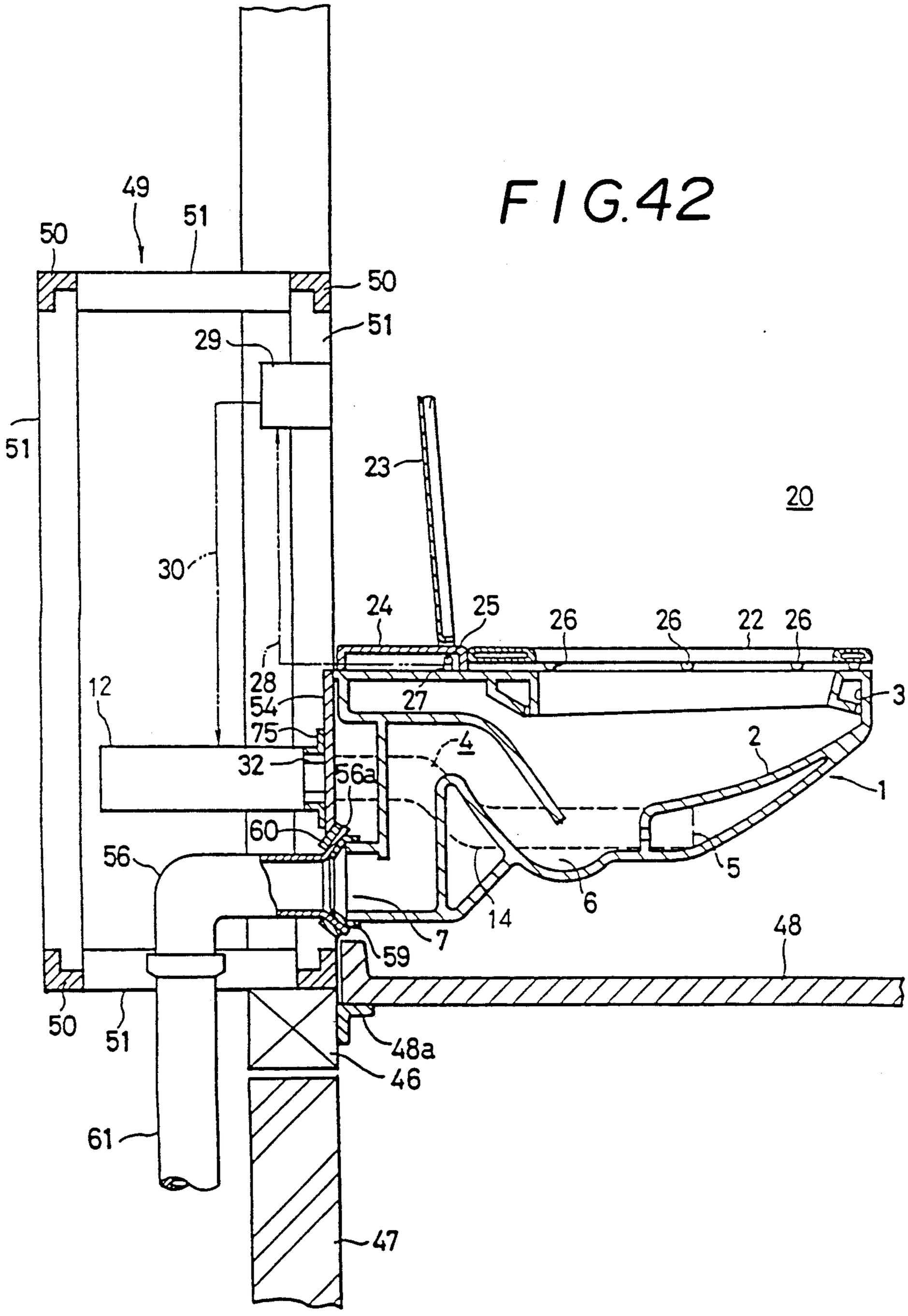
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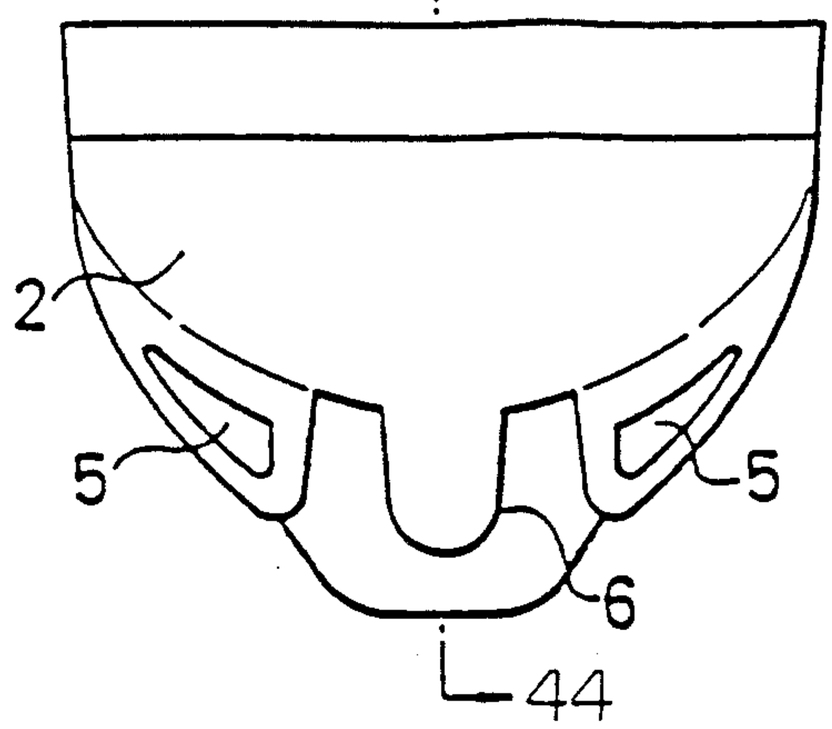
FIG.43



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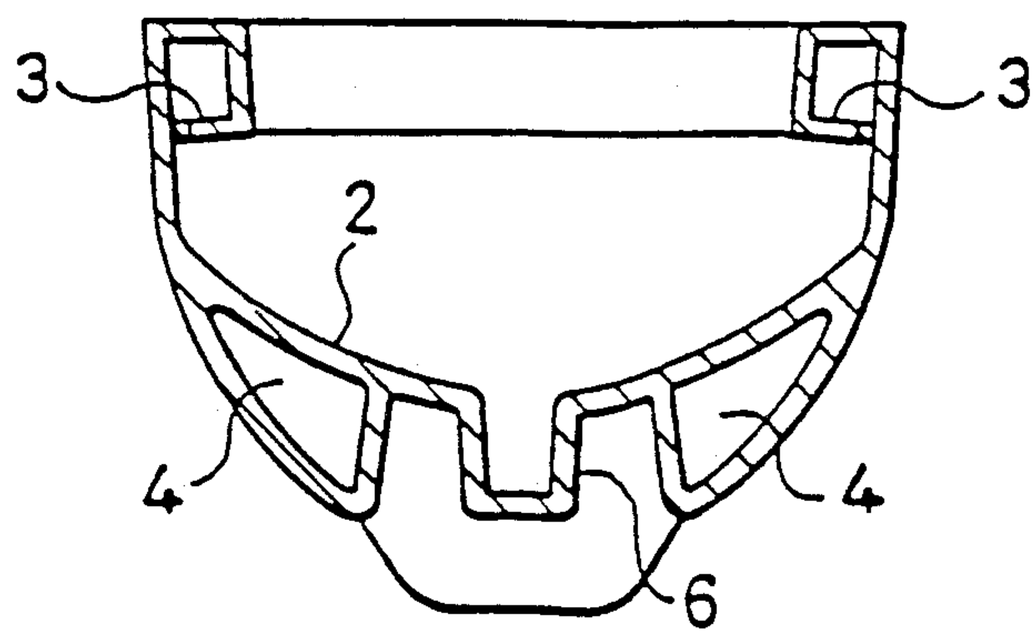

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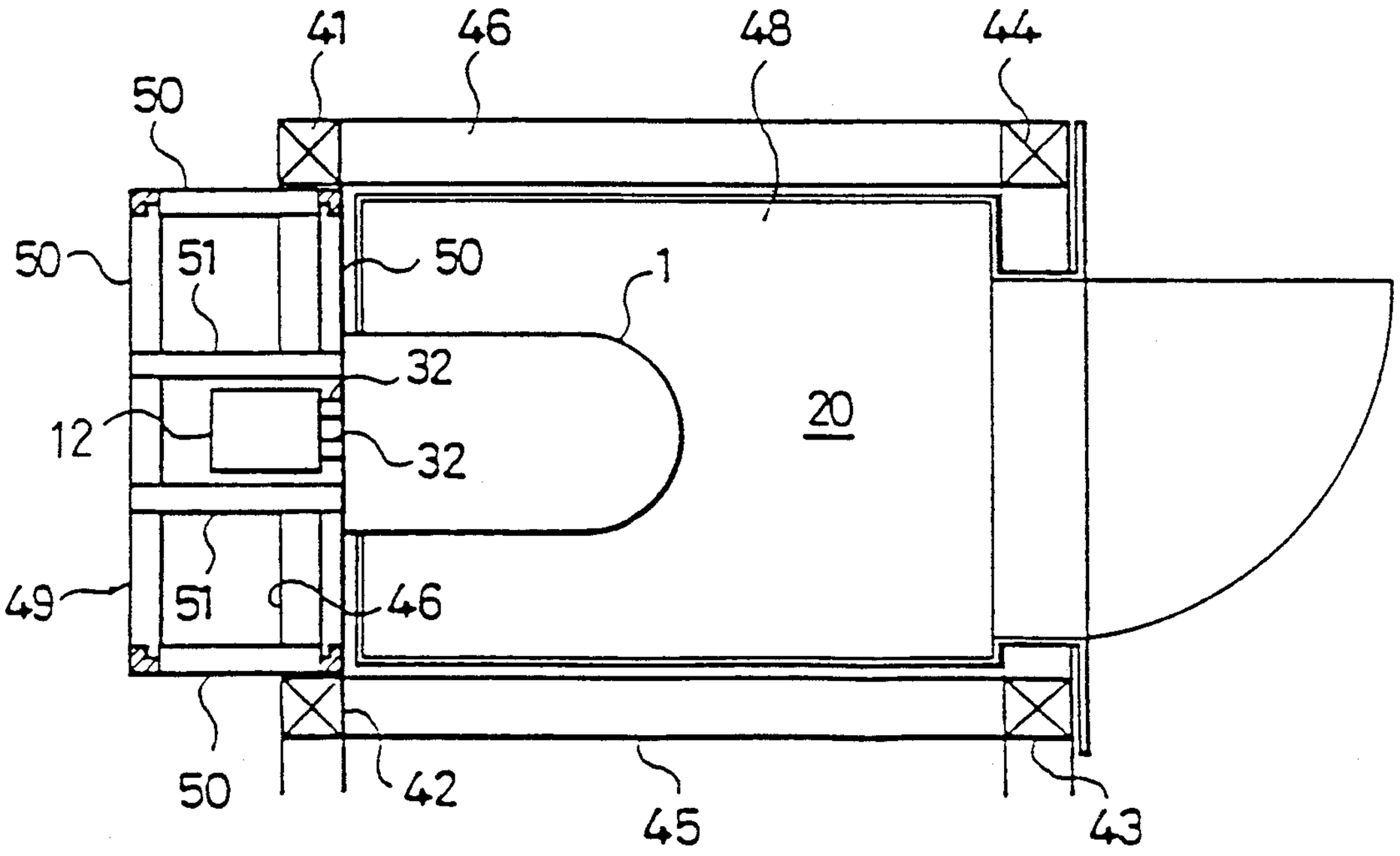

FIG.46

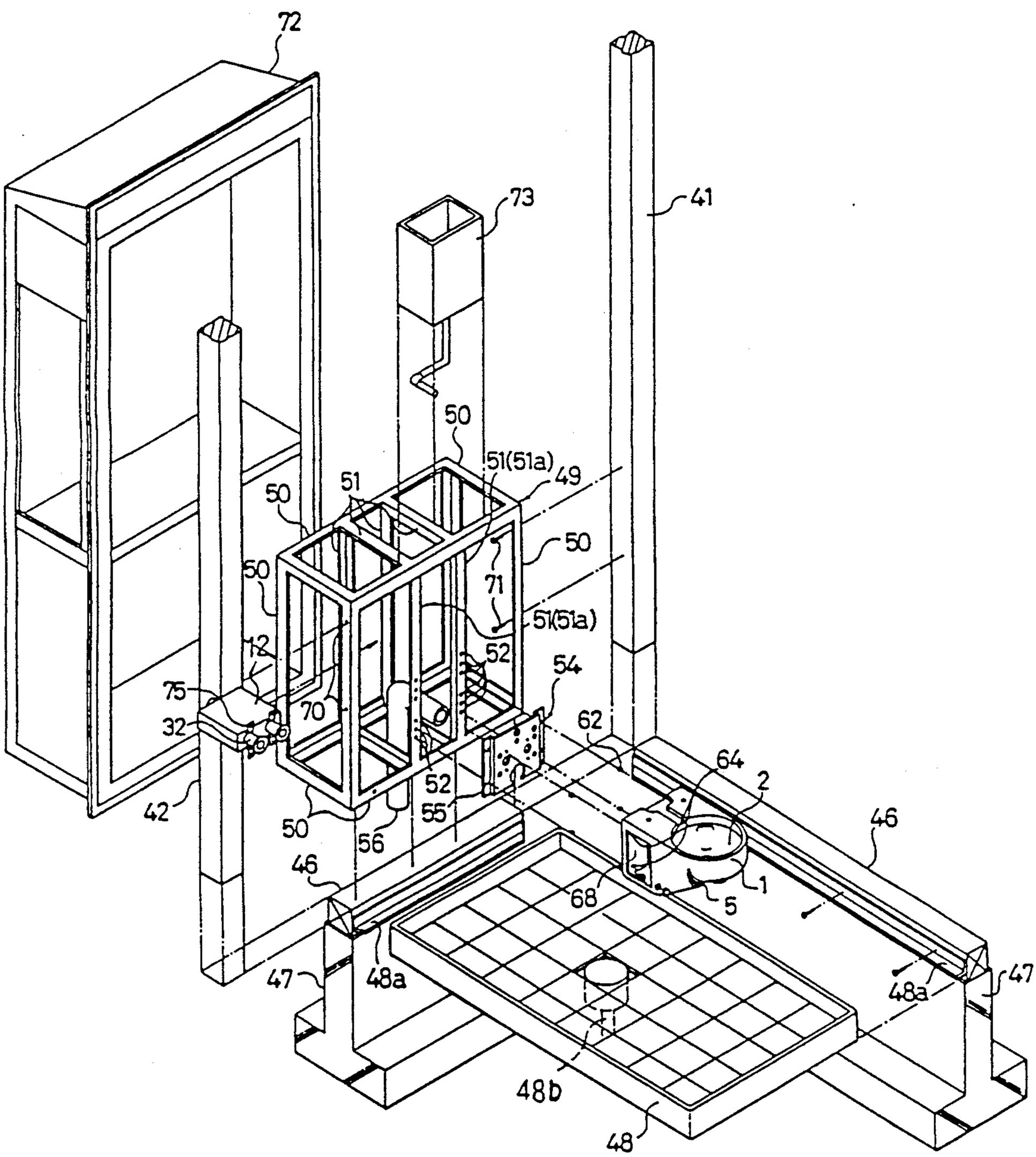
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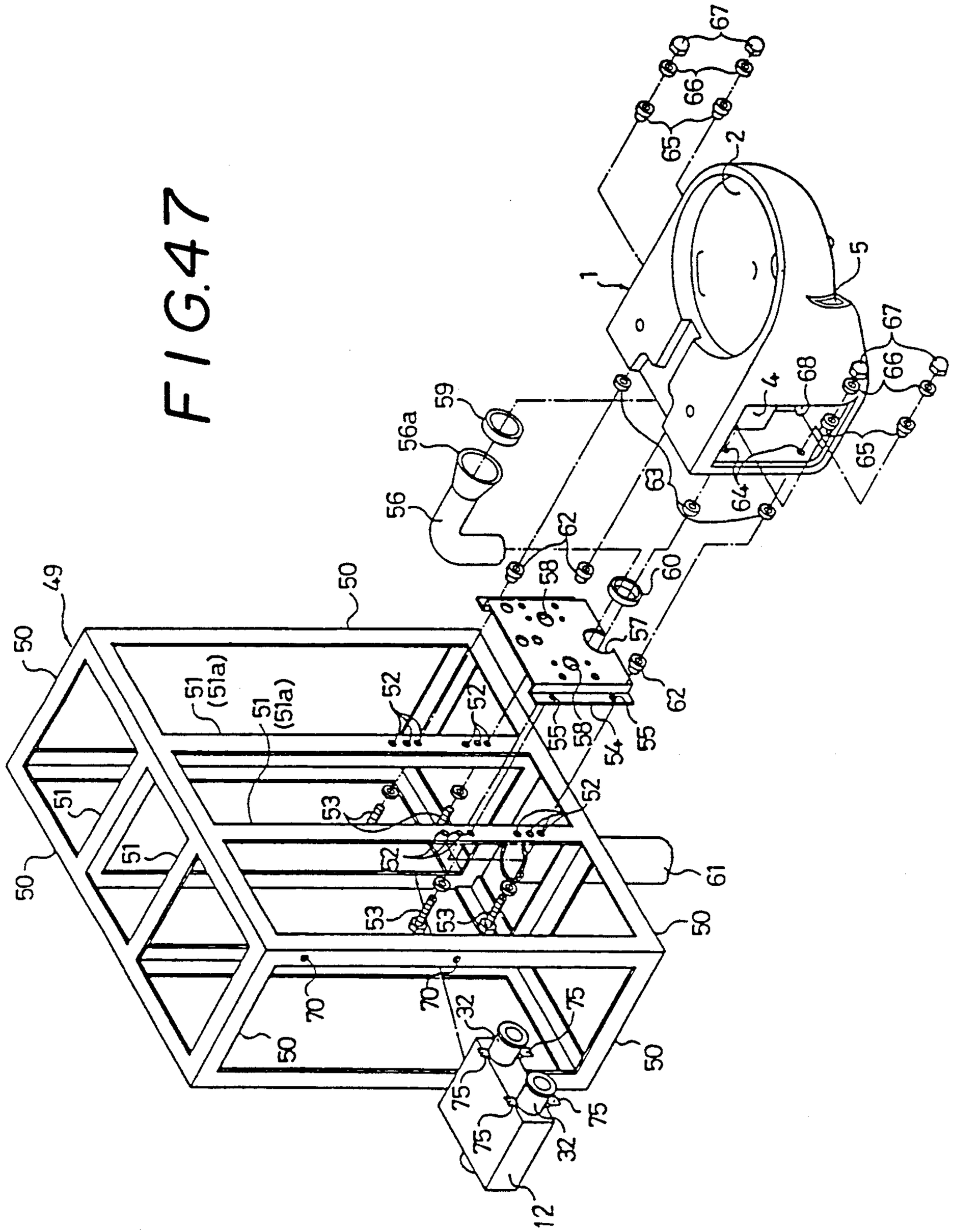
FIG.47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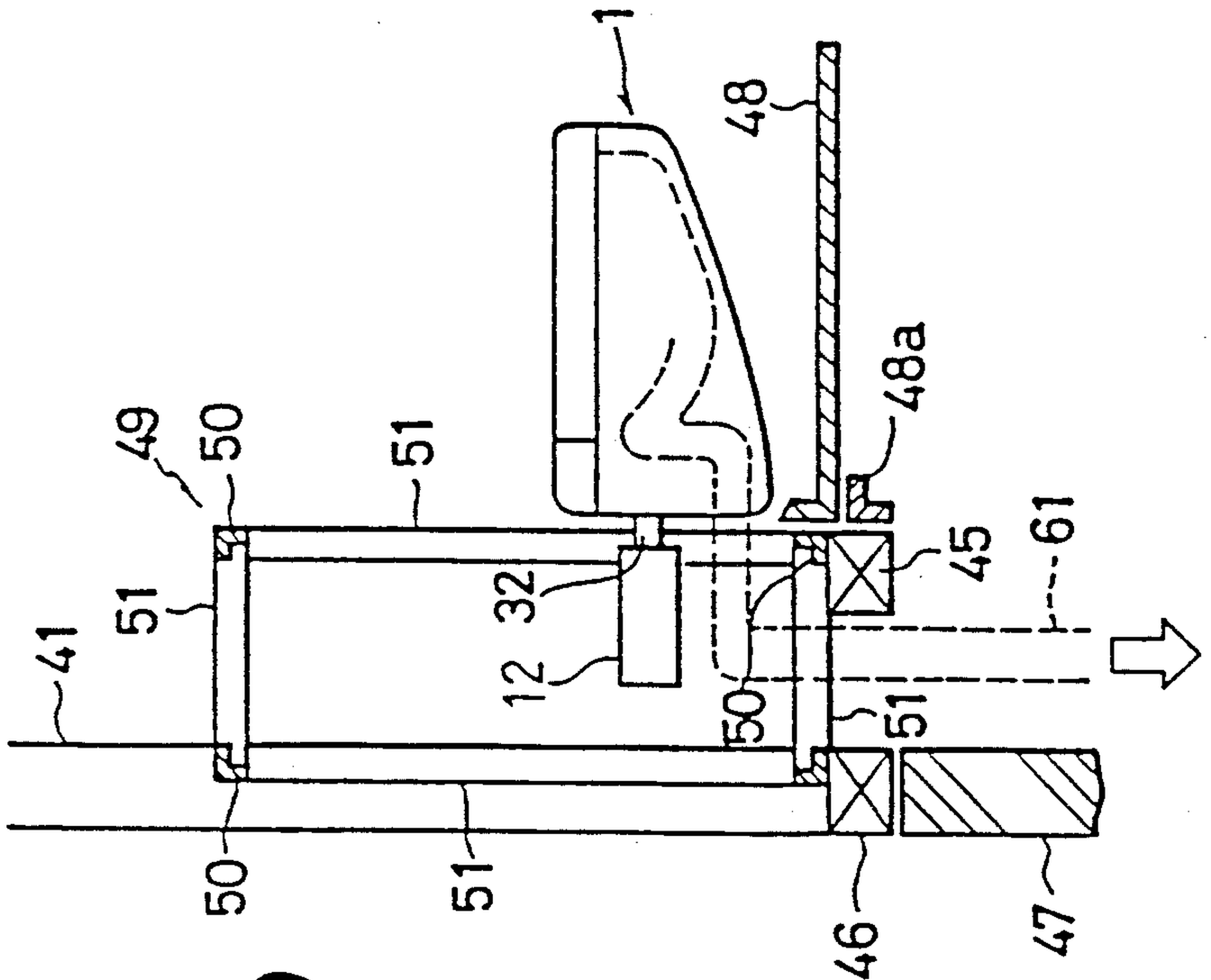


FIG.49

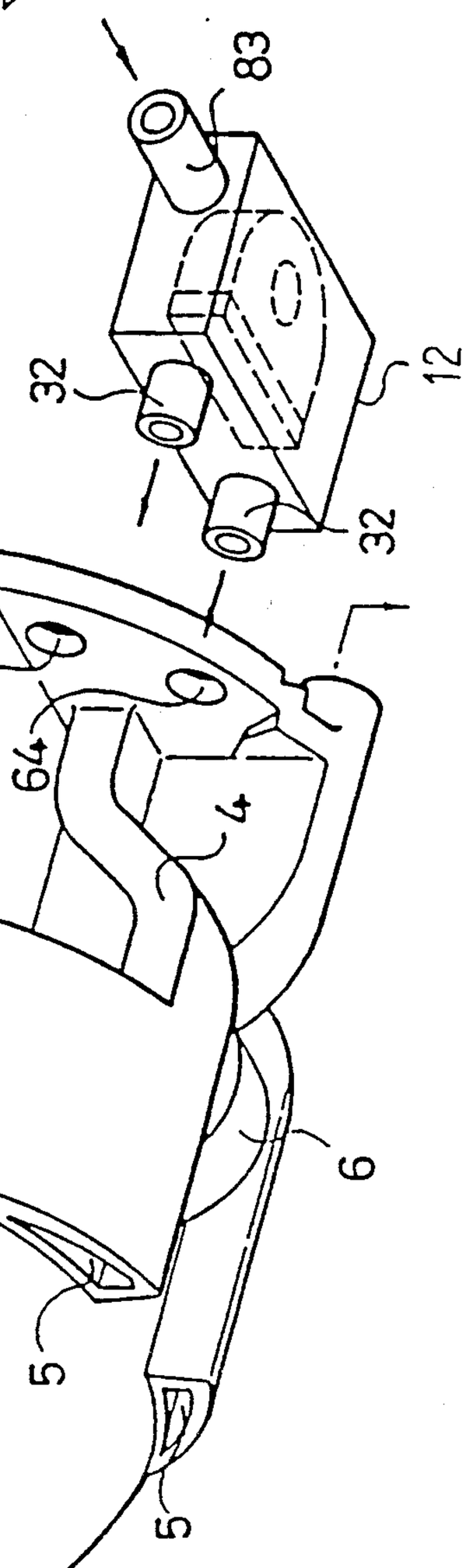


FIG.48

FIG.50

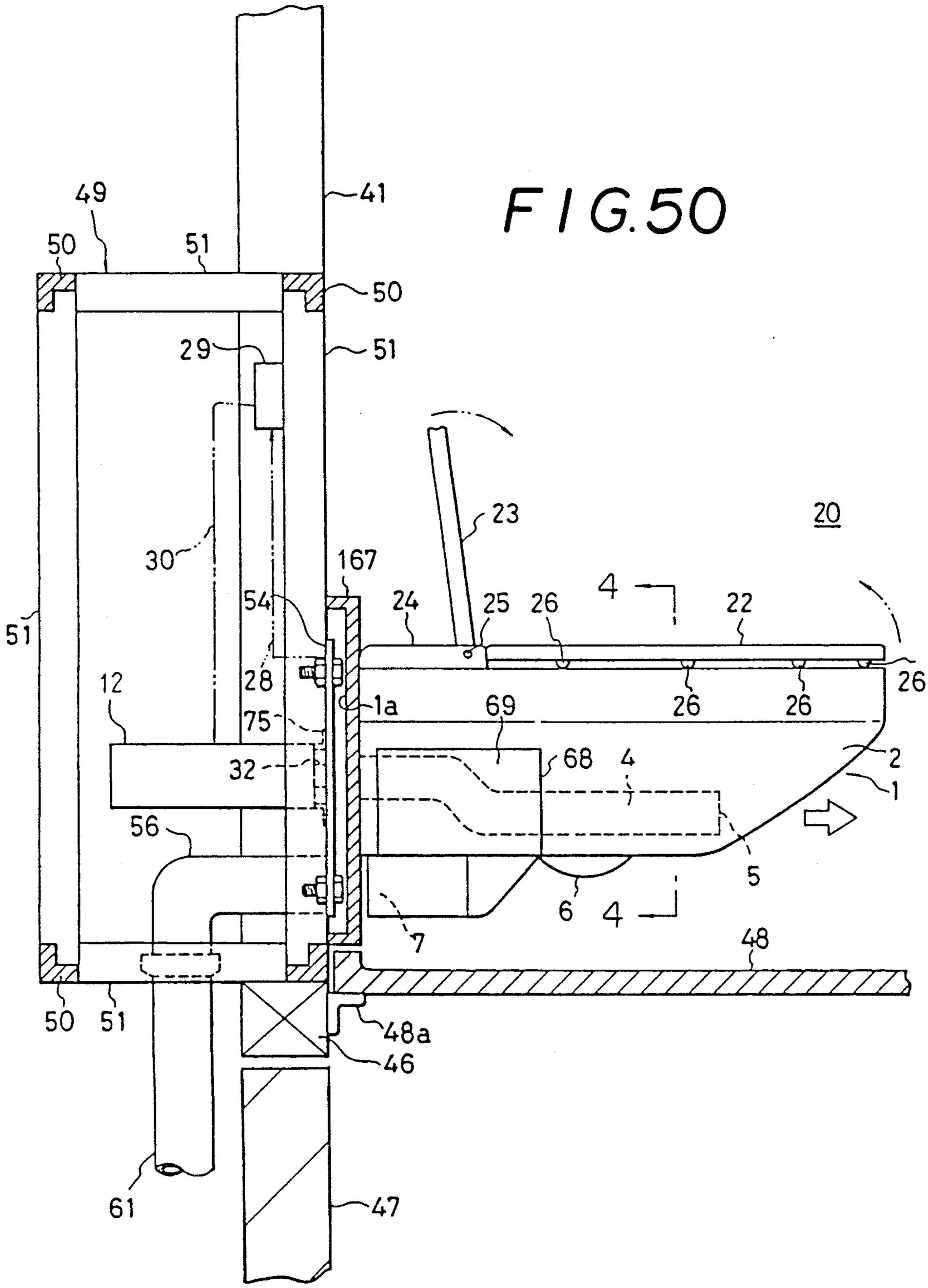
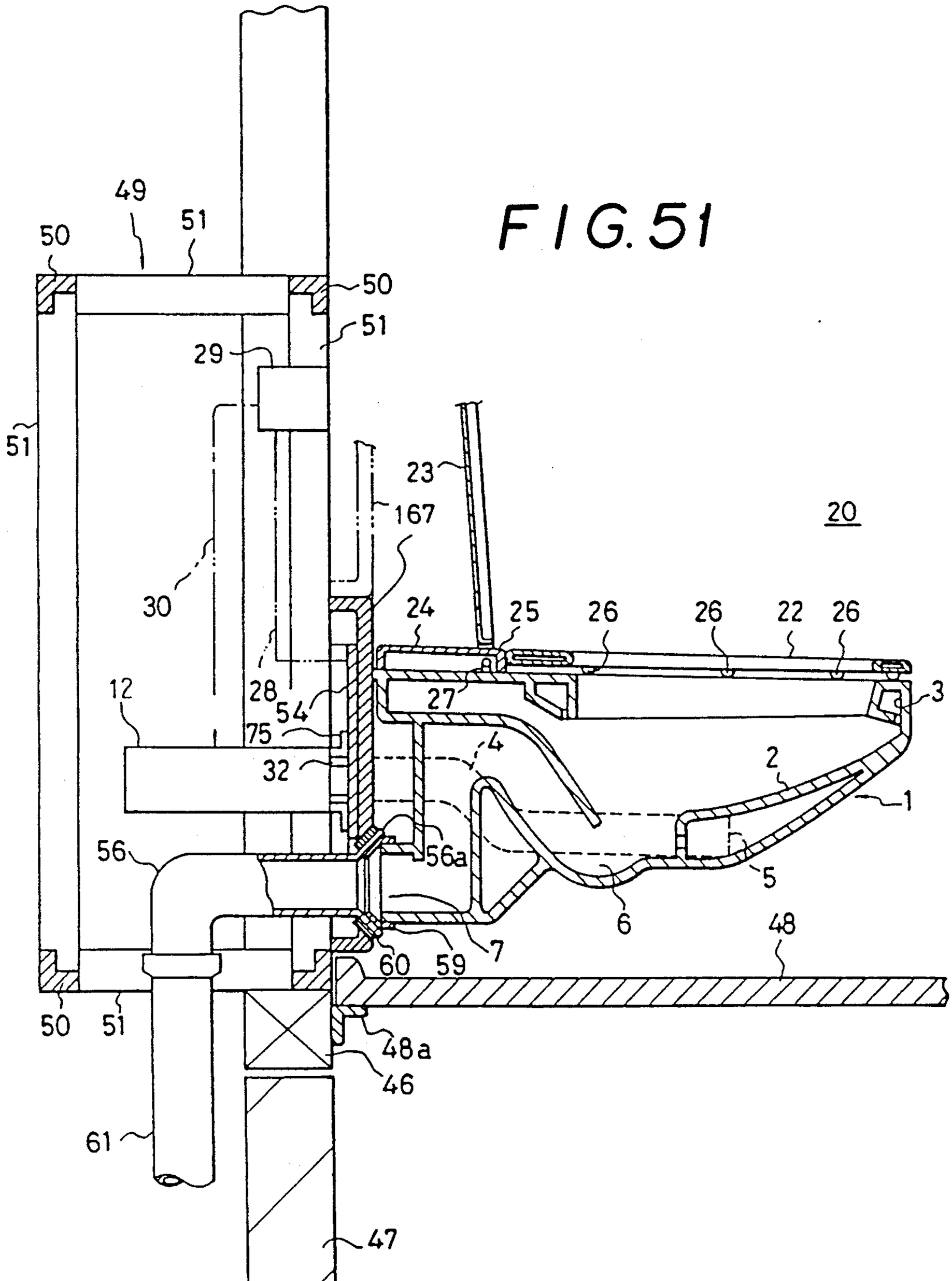

49
41
50
51
50
29
51
30
167
54
24
25
26
4
22
51
28
26
12
1a
69
26
26
75
68
4
2
32
1
56
5
6
4
7
48
50
51
48a
46
61
47

FIG. 51


49
50
51
50
51
29
51
23
167
30
24
25
26
26
22
26
12
28
54
27
3
75
4
32
2
1
56
56a
5
6
48
7
60
59
50
51
48a
46
61
47

20

FIG.52

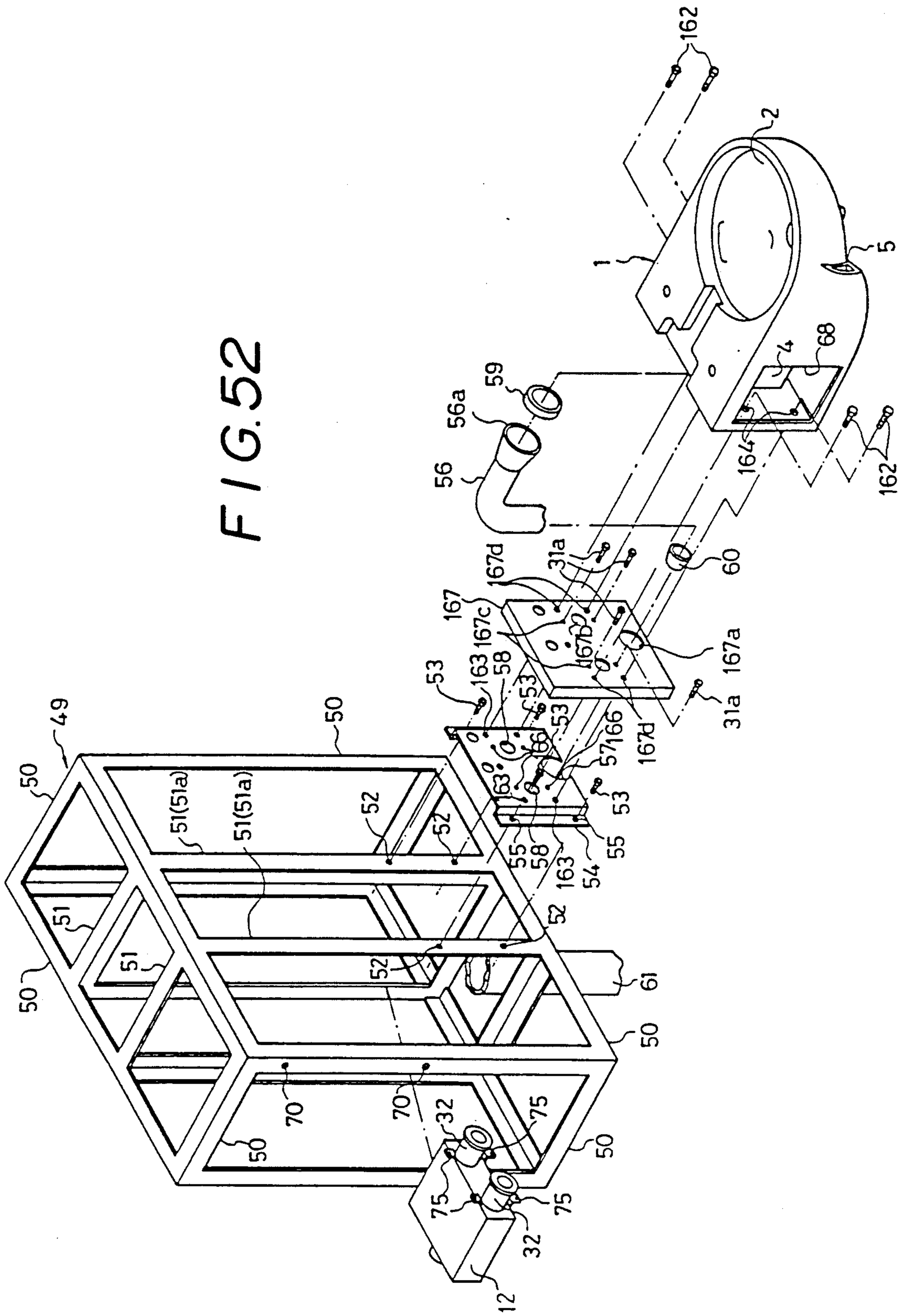

162
2
1
5
68
4
164
59
56a
56
60
167d
31a
167
167c
167b
167a
163
58
53
57
166
55
54
49
50
51(51a)
52
51
61
70
32
75
12

FIG.53

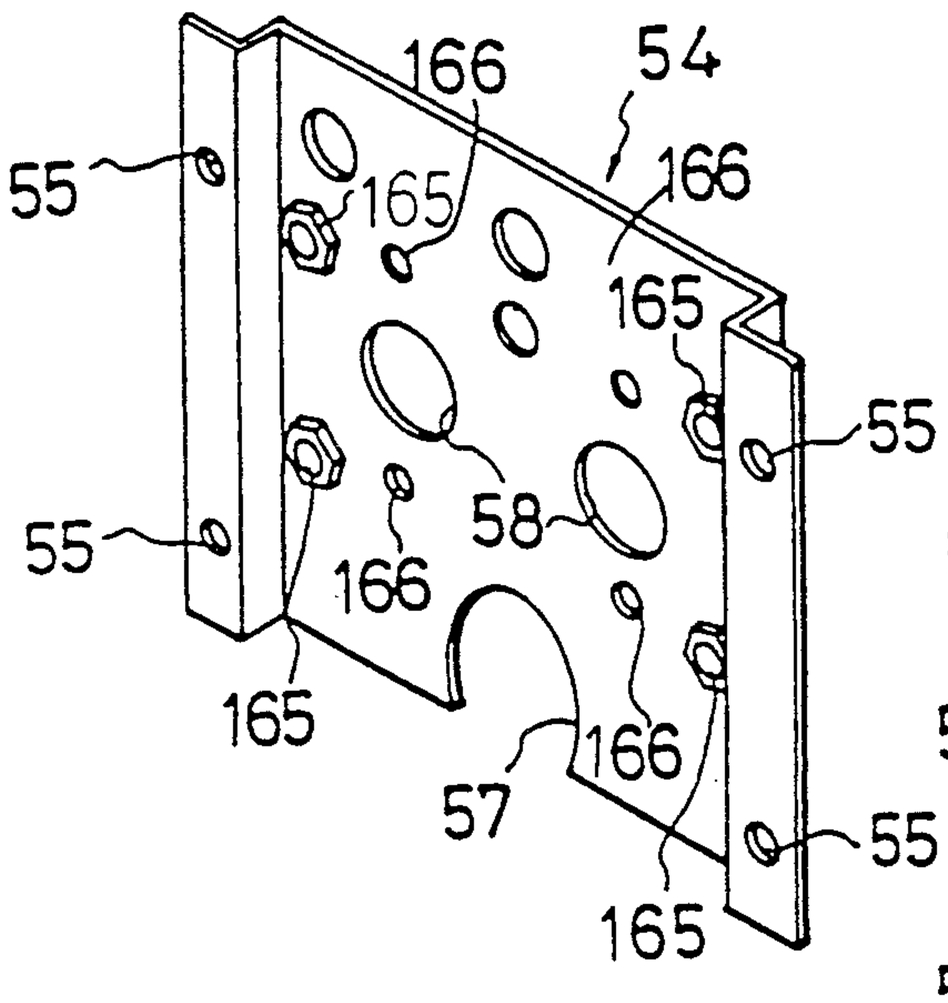


FIG.54

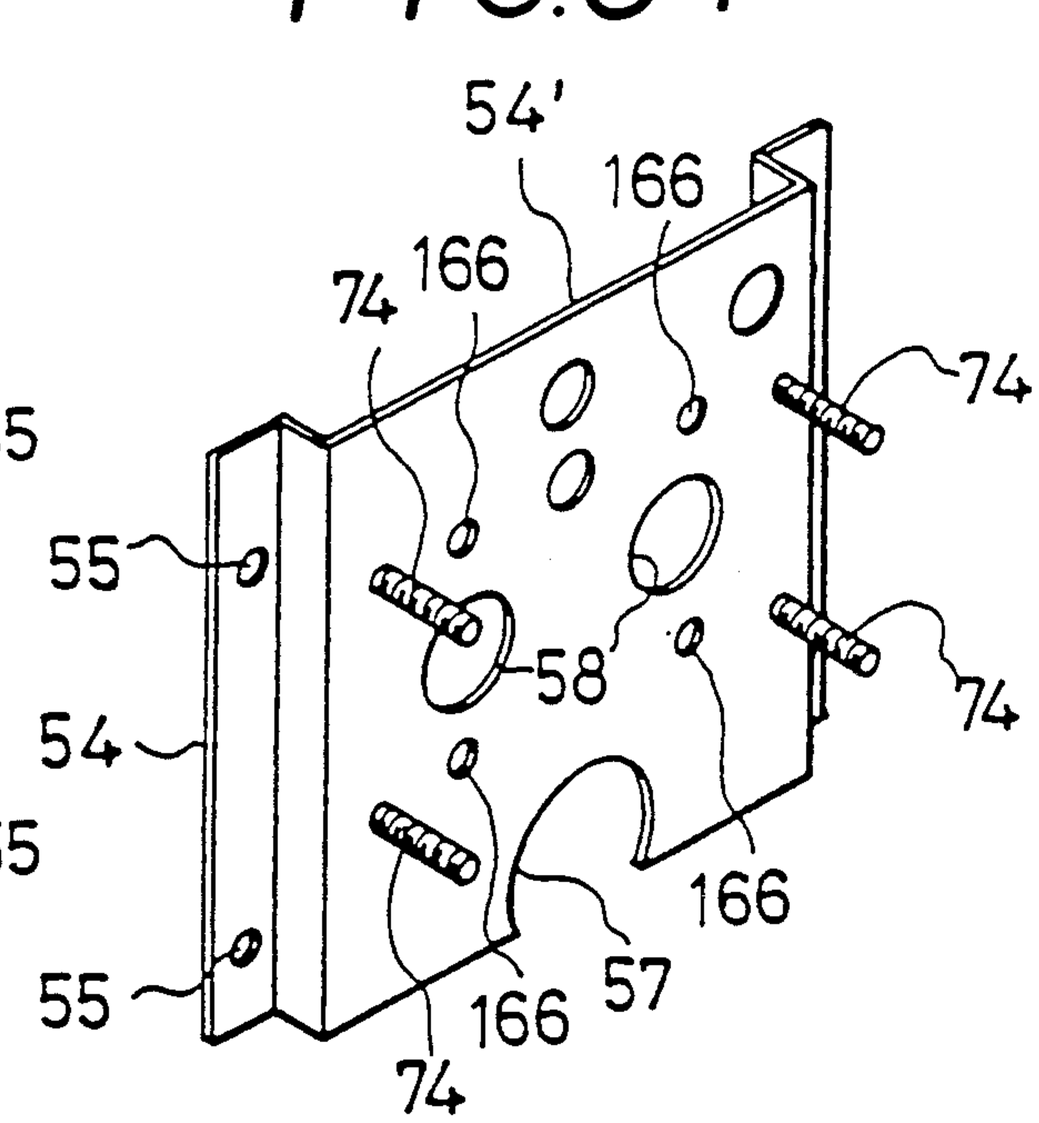
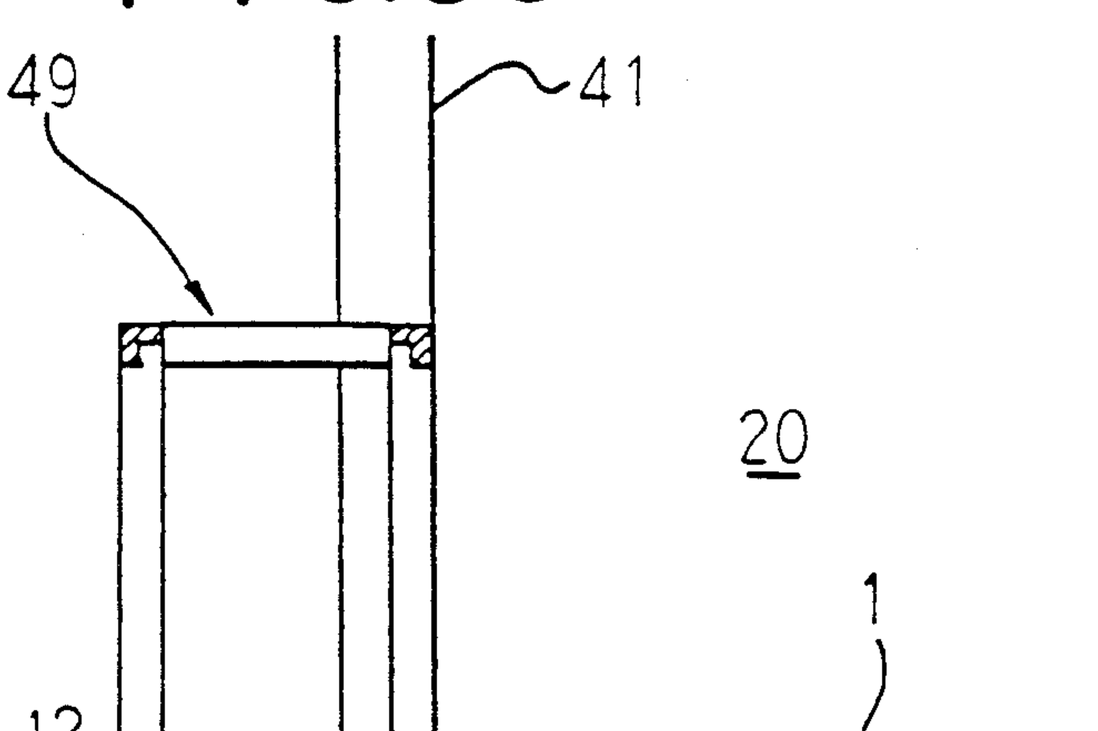


FIG.55



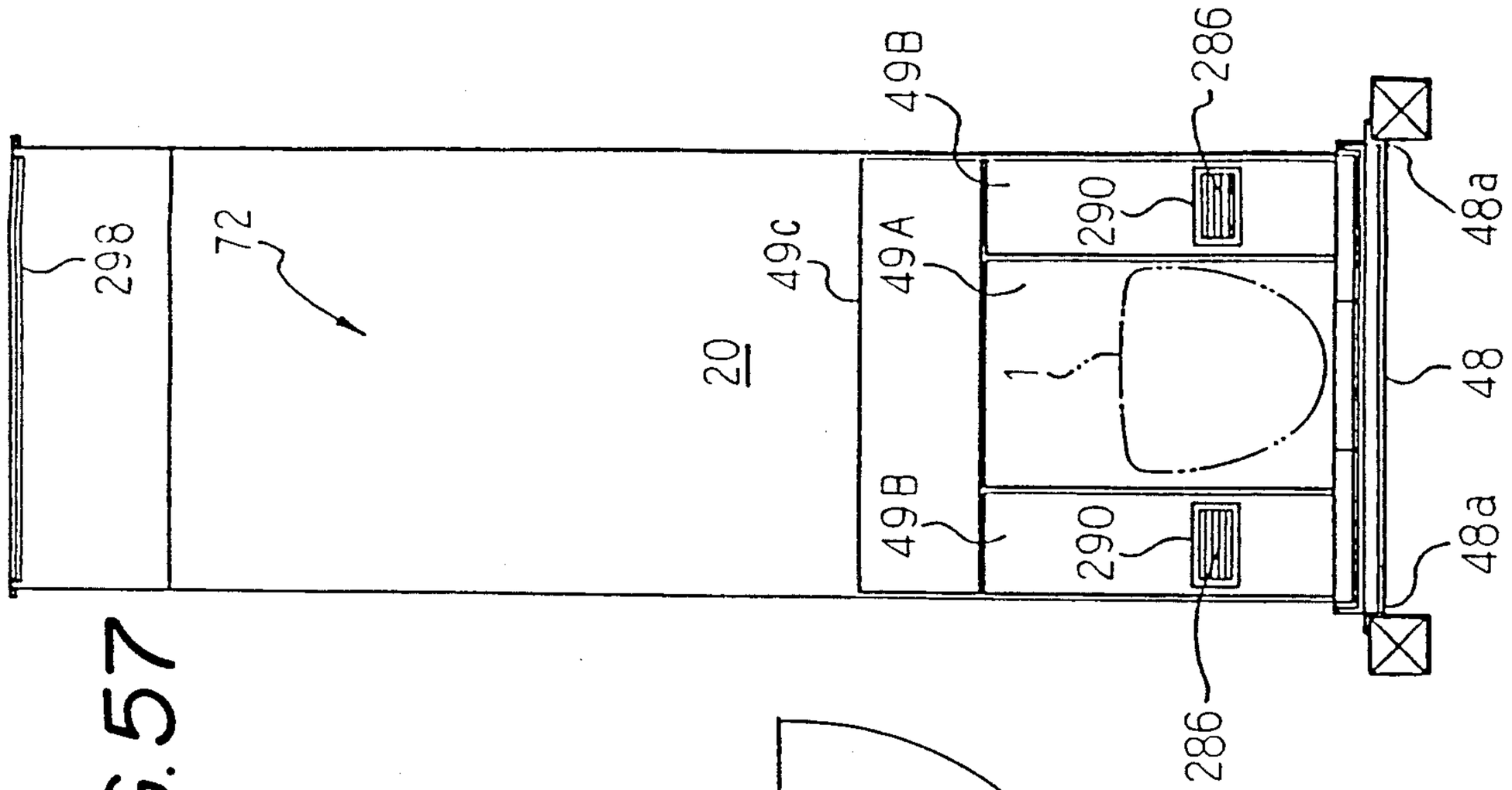

49B
286
298
72
49c
49A
290
48a
20
1
48
49B
290
48a
286

FIG.57

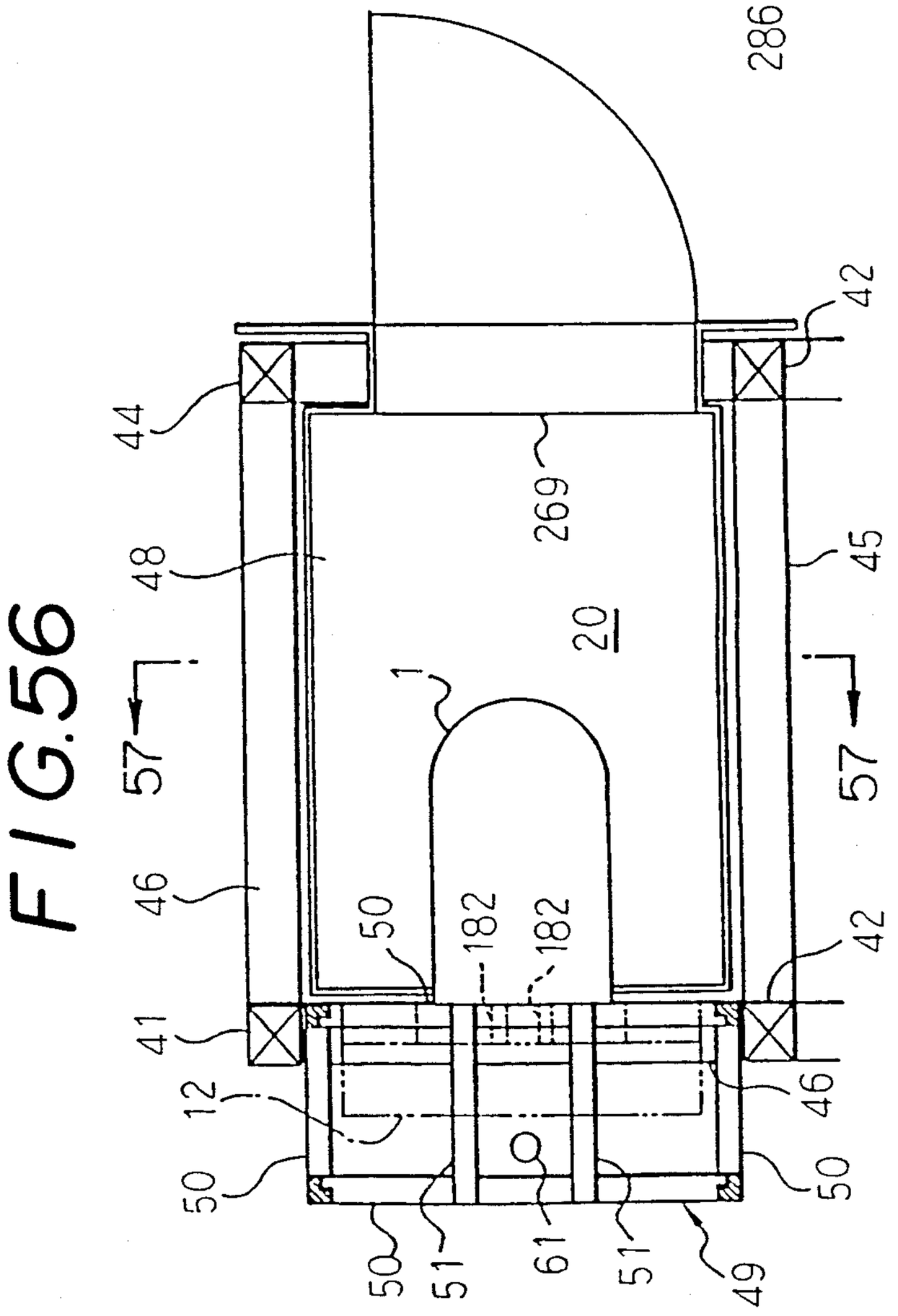

42
44
269
48
45
57
20
1
57
46
50
182
182
42
41
12
46
50
50
51
61
51
49

FIG.56

FIG.58

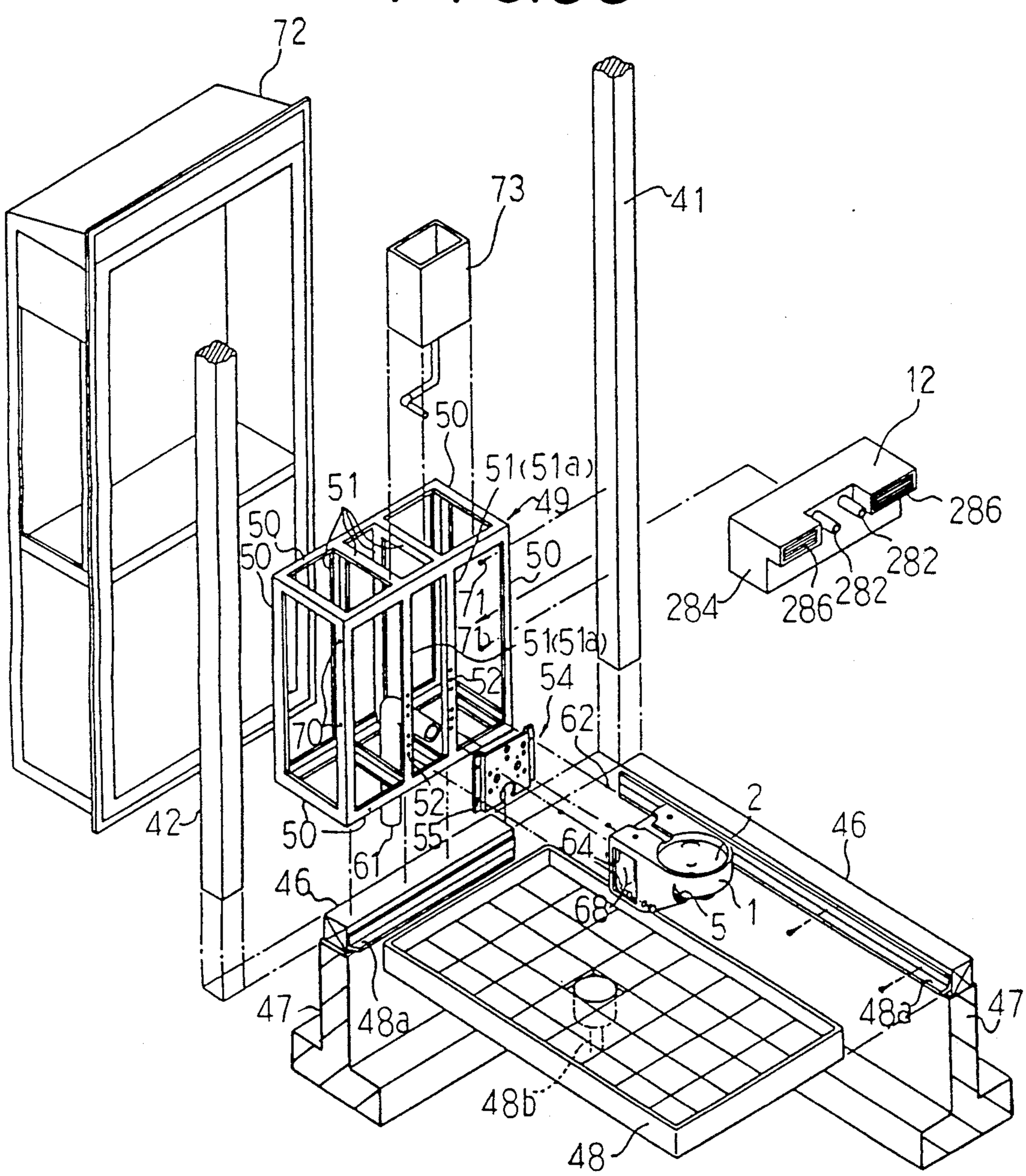

72
73
41
50
51
51(51a)
49
50
50
71
71b
51(51a)
52
54
62
70
52
55
61
50
42
12
286
282
282
284
286
2
46
64
68
5
1
46
47
48a
48a
47
48b
48

FIG.59

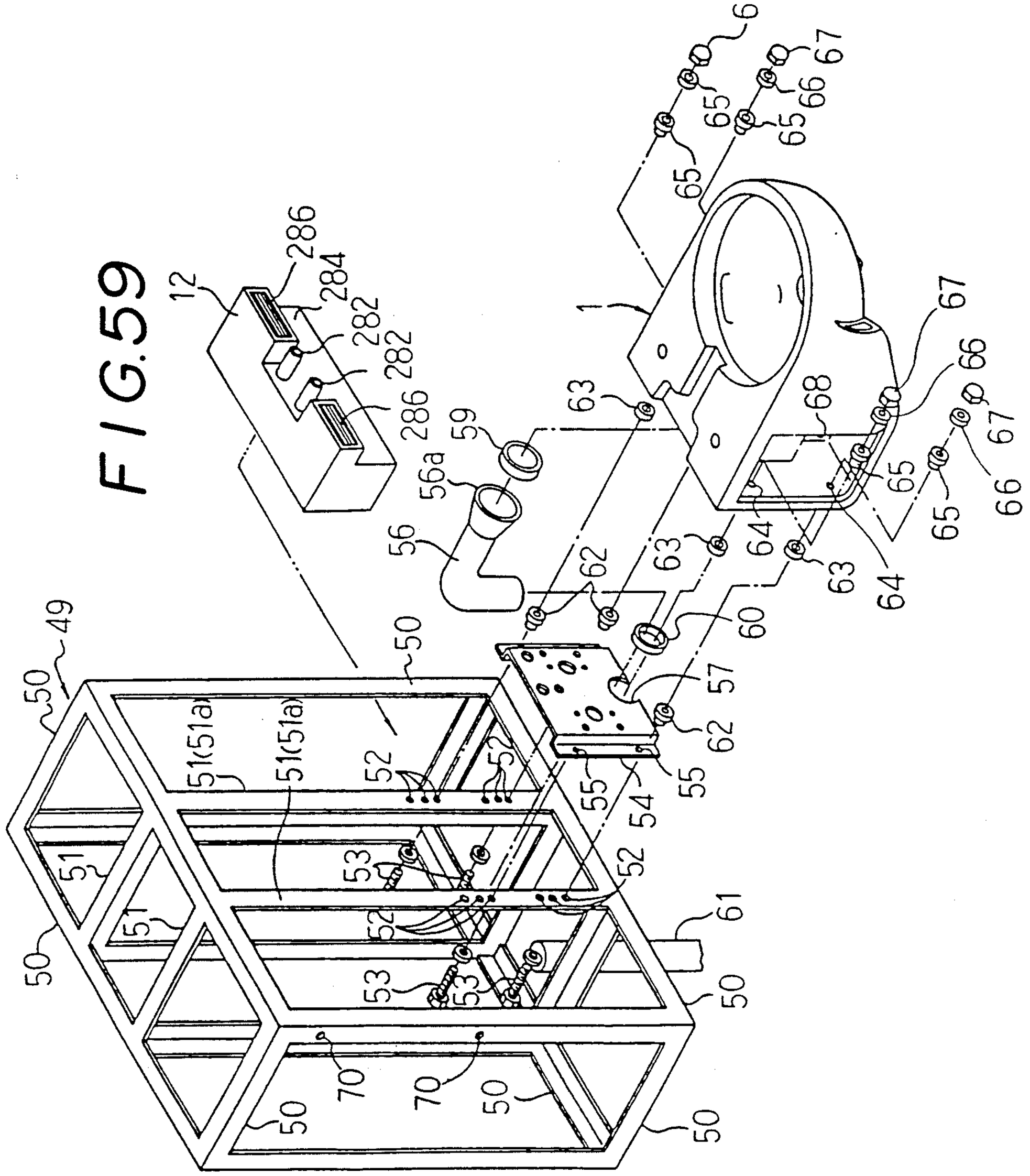

12
286
284
282
282
286
59
56a
56
63
62
63
64
63
64
65
66
67
68
1
49
50
51(51a)
51
52
53
54
55
57
60
61
70

FIG.60

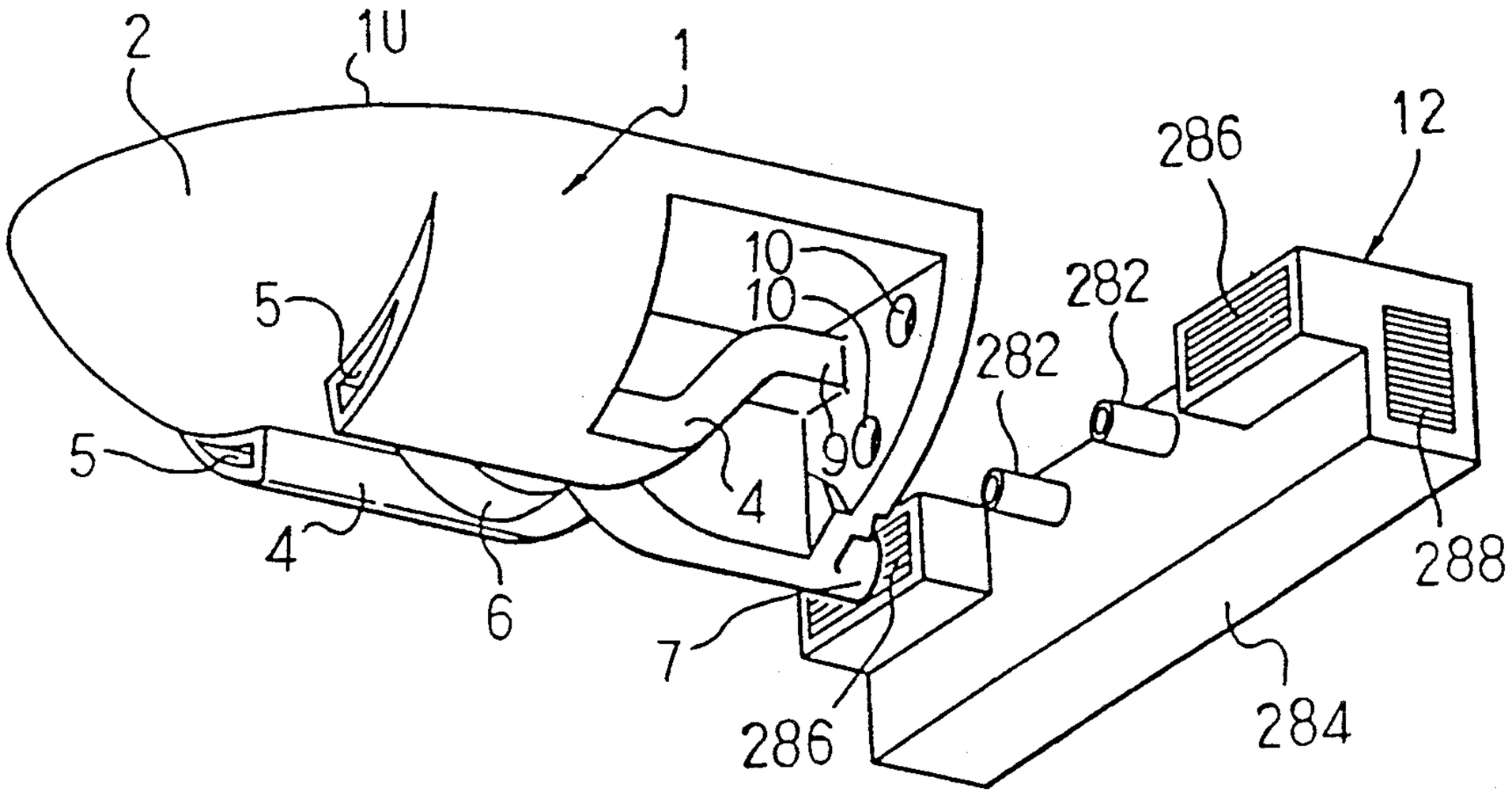


FIG.61

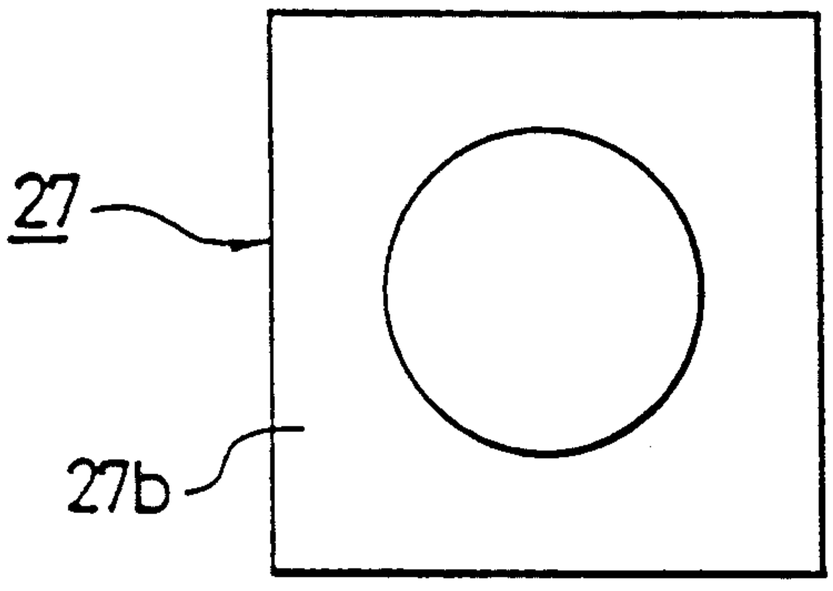


FIG.62

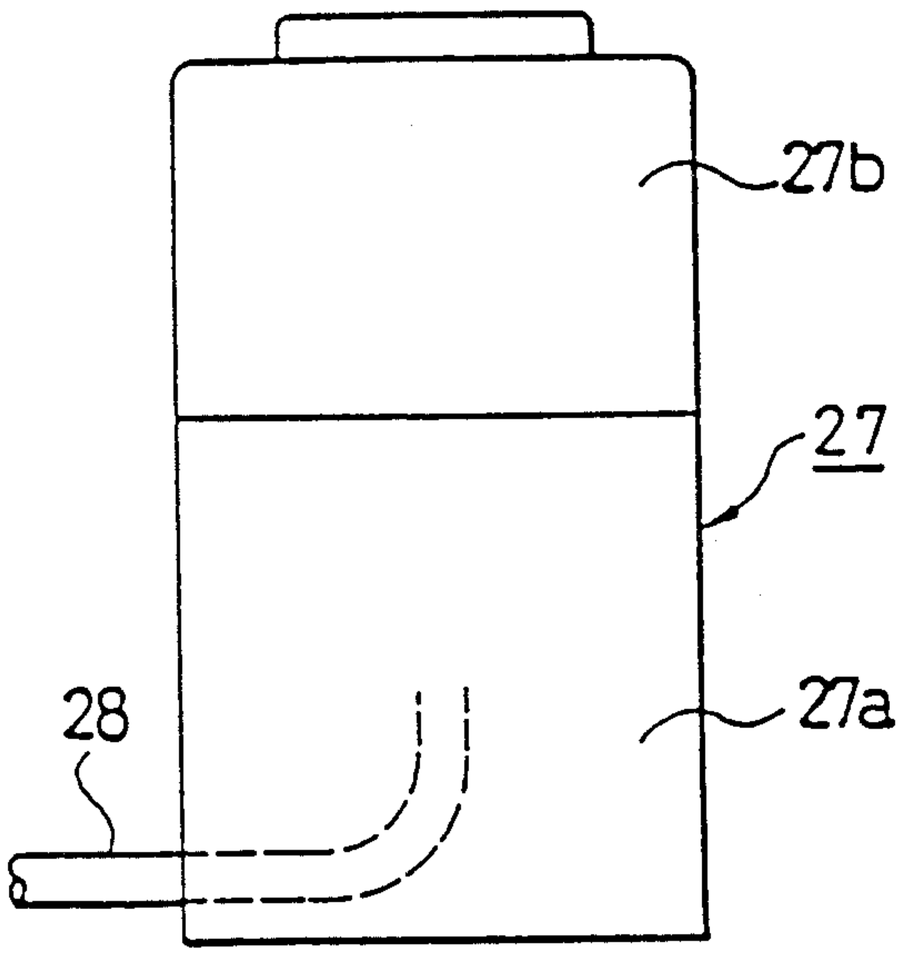


FIG.63

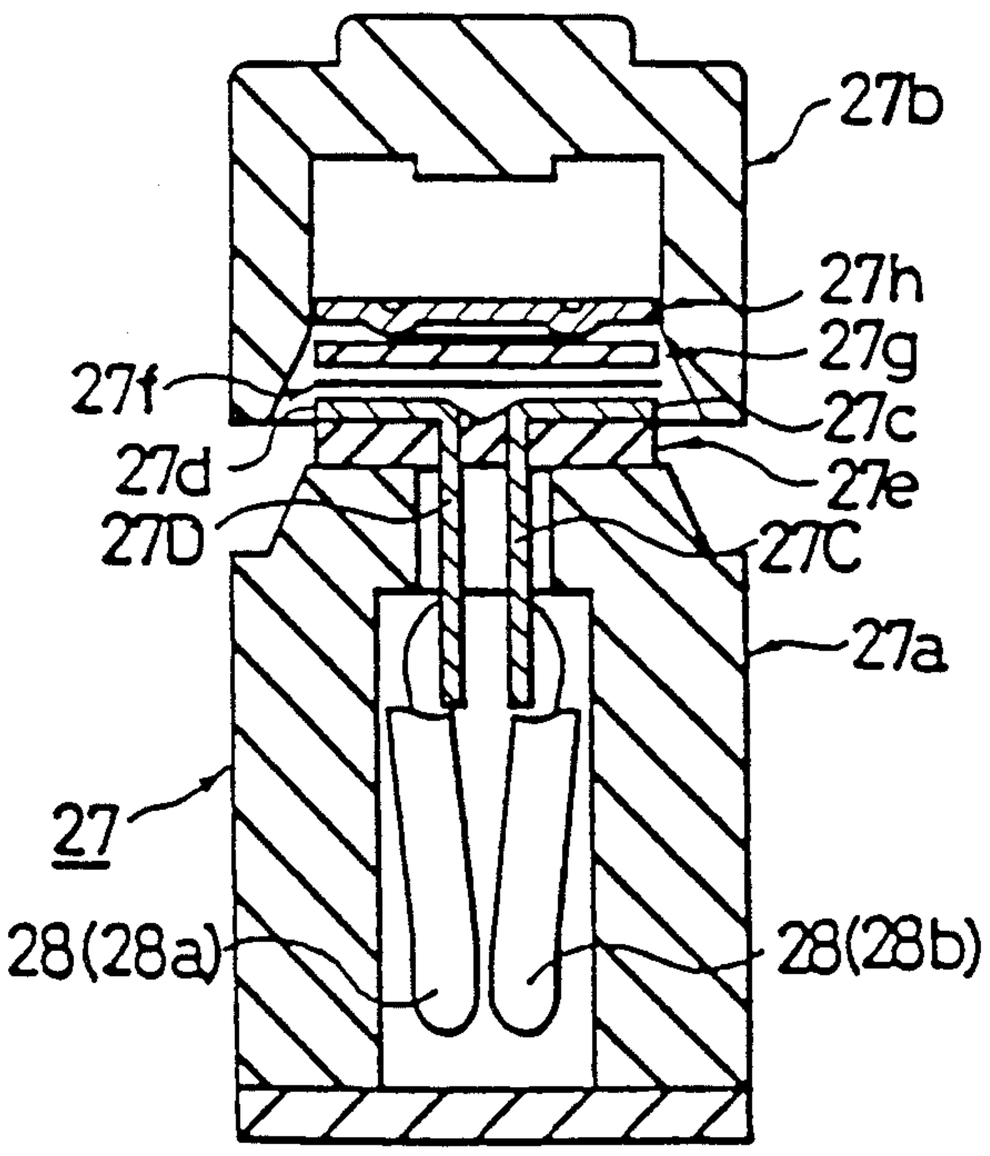
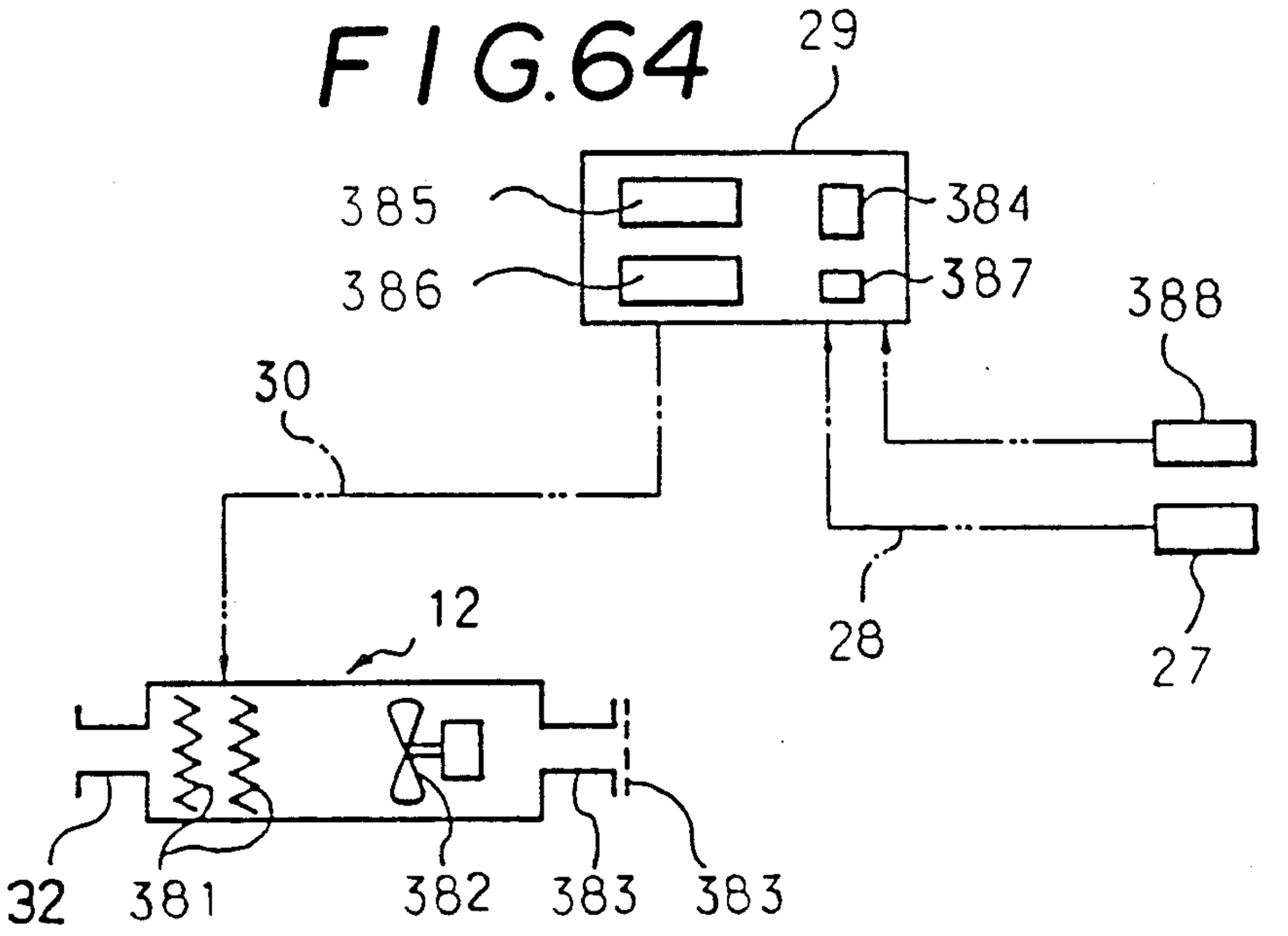


FIG.64



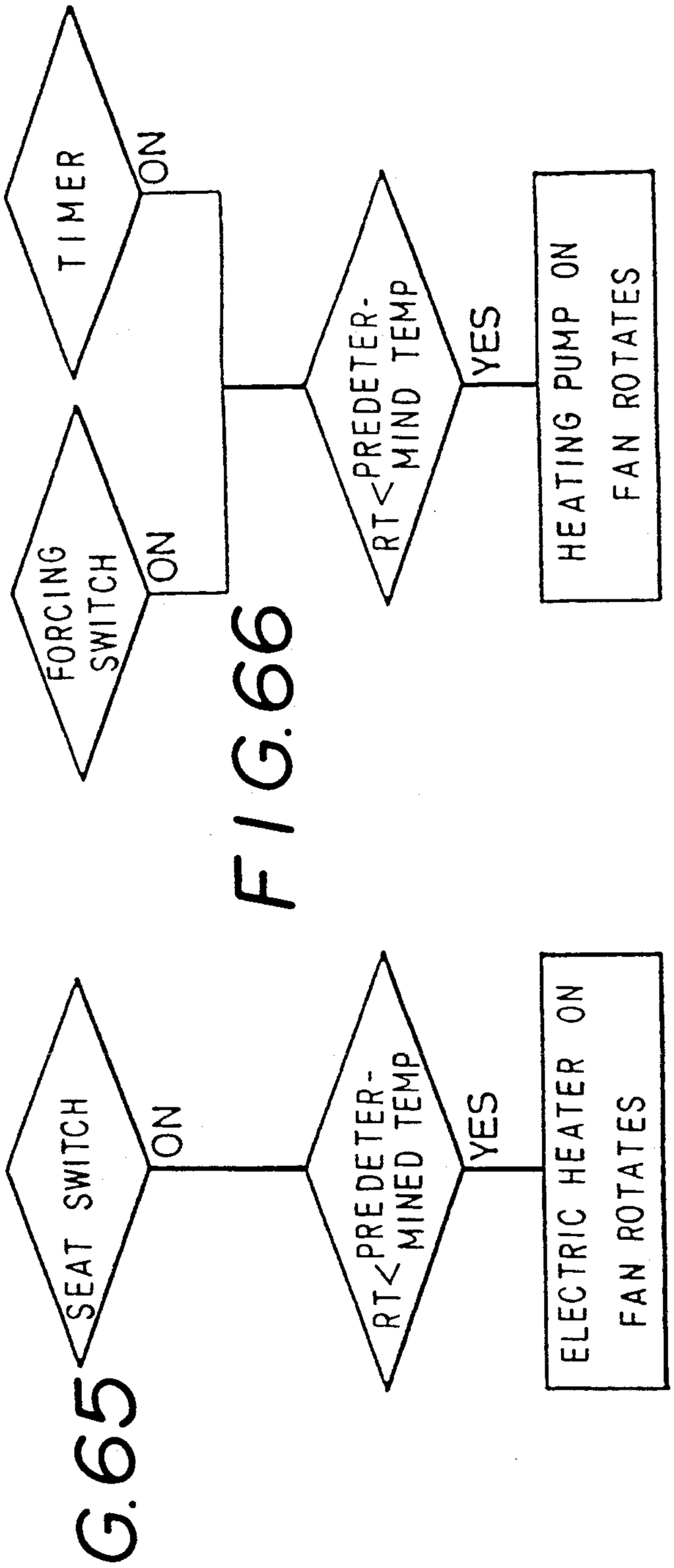


FIG. 66

65

FIG.

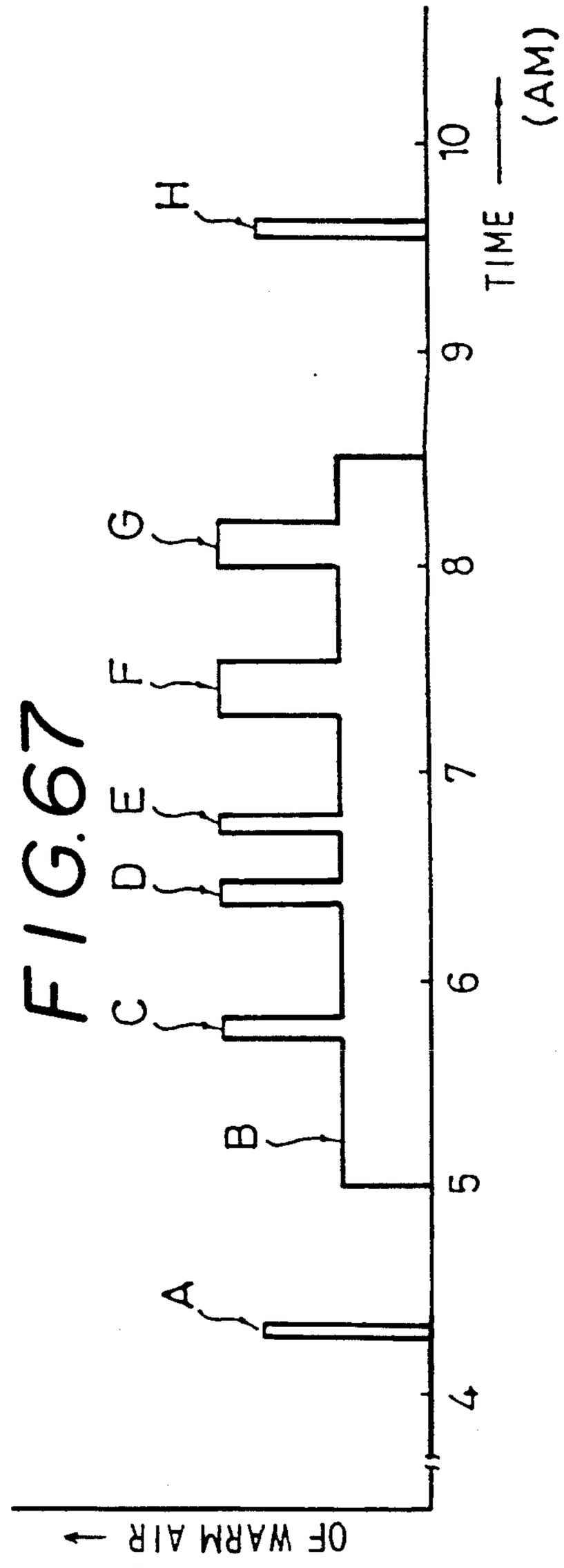


FIG. 67

FIG.68

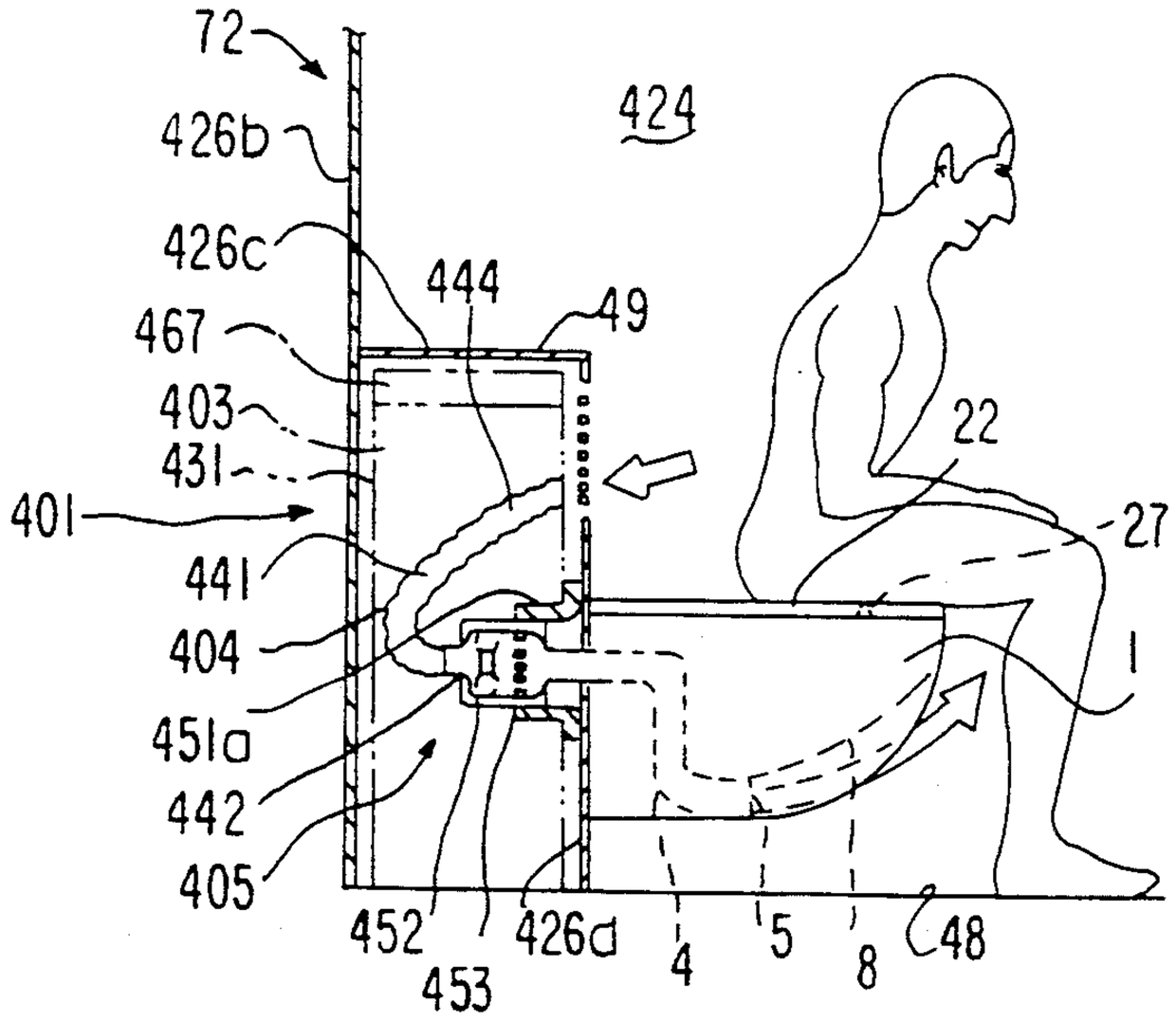

72
426b
426c
467
403
431
401
441
404
451a
442
405
452
453
426d
4
5
8
48
424
444
49
22
27
1

FIG.69

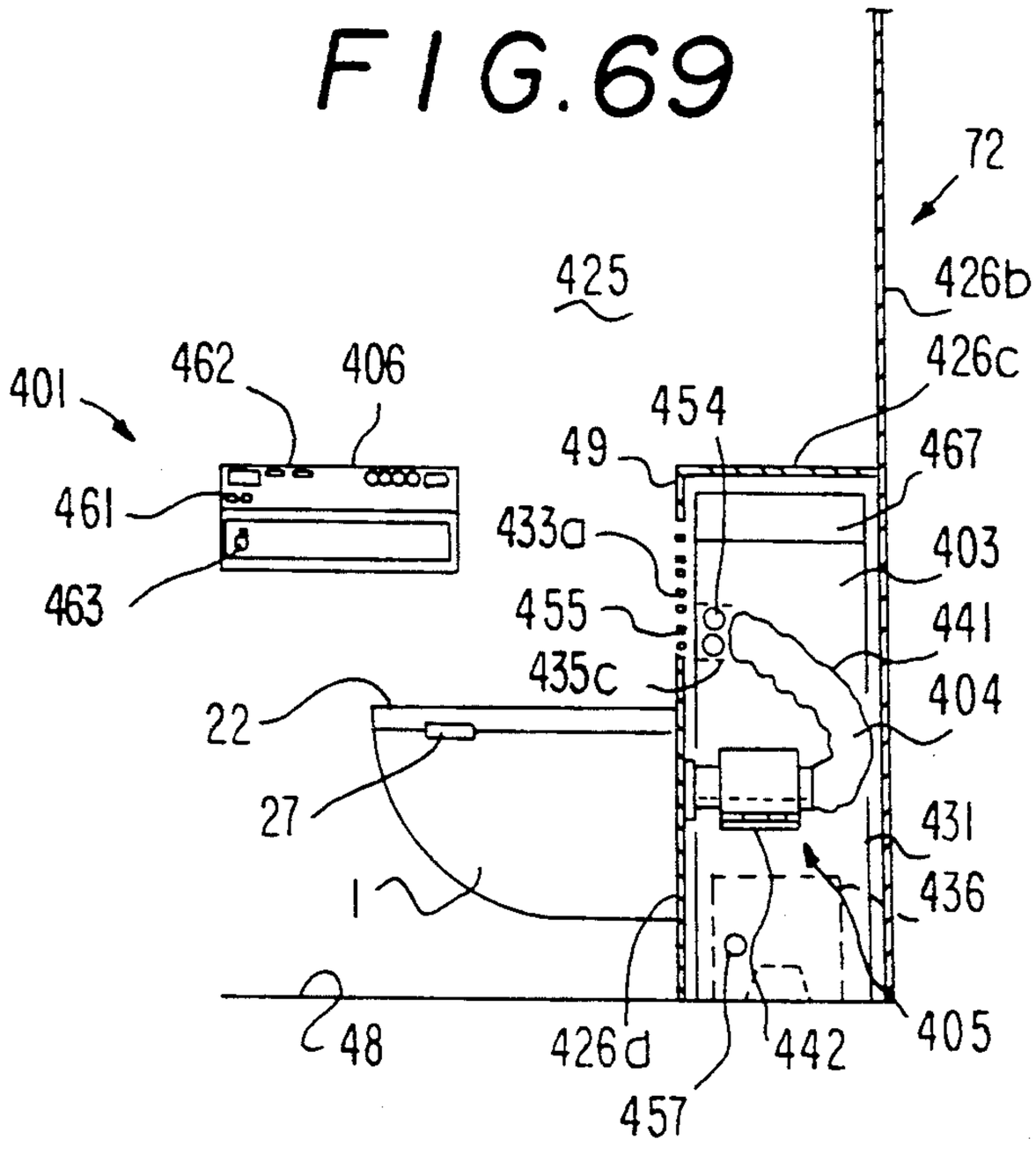

72
425
426b
426c
401
462
406
454
49
467
461
433a
403
463
455
441
435c
404
22
431
27
436
1
48
426d
442
405
457

FIG. 70

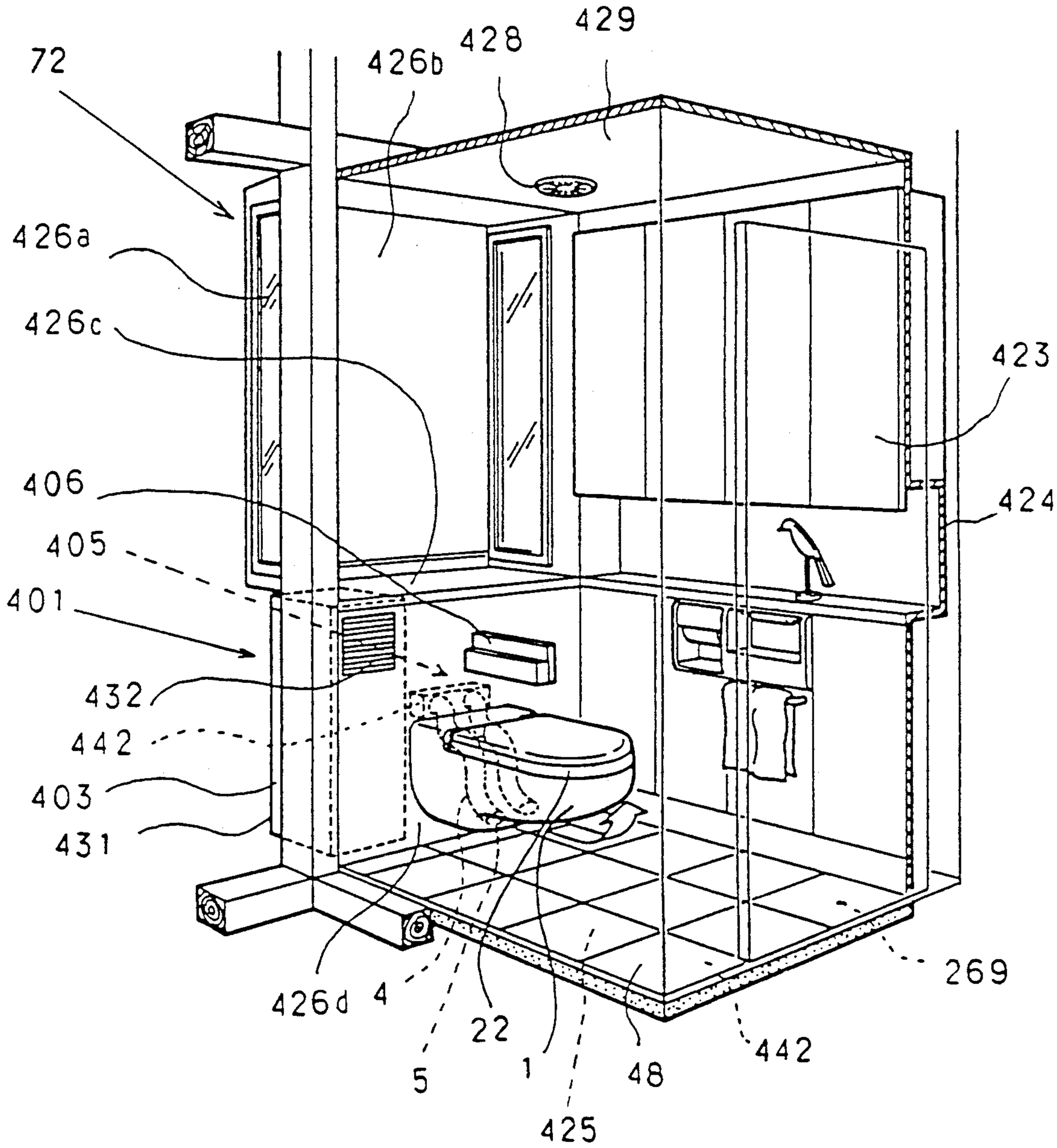

72
426b
428
429
426a
426c
423
406
424
405
401
432
442
403
431
426d
4
22
1
48
442
269
5
425

FIG.72

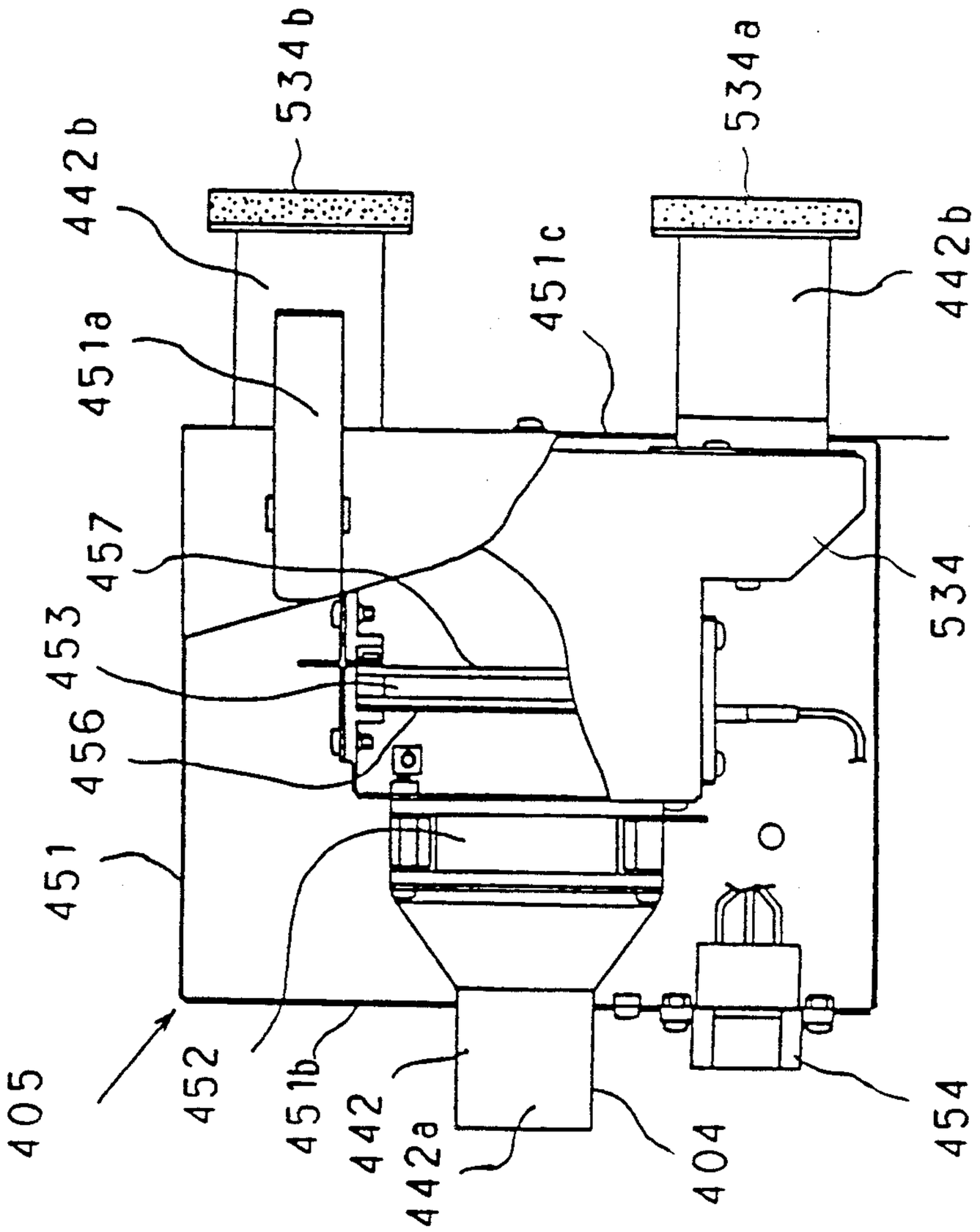

534b
442b
534a
442b
451a
451c
457
534
453
456
451
405
452
451b
442
442a
404
454

FIG.71

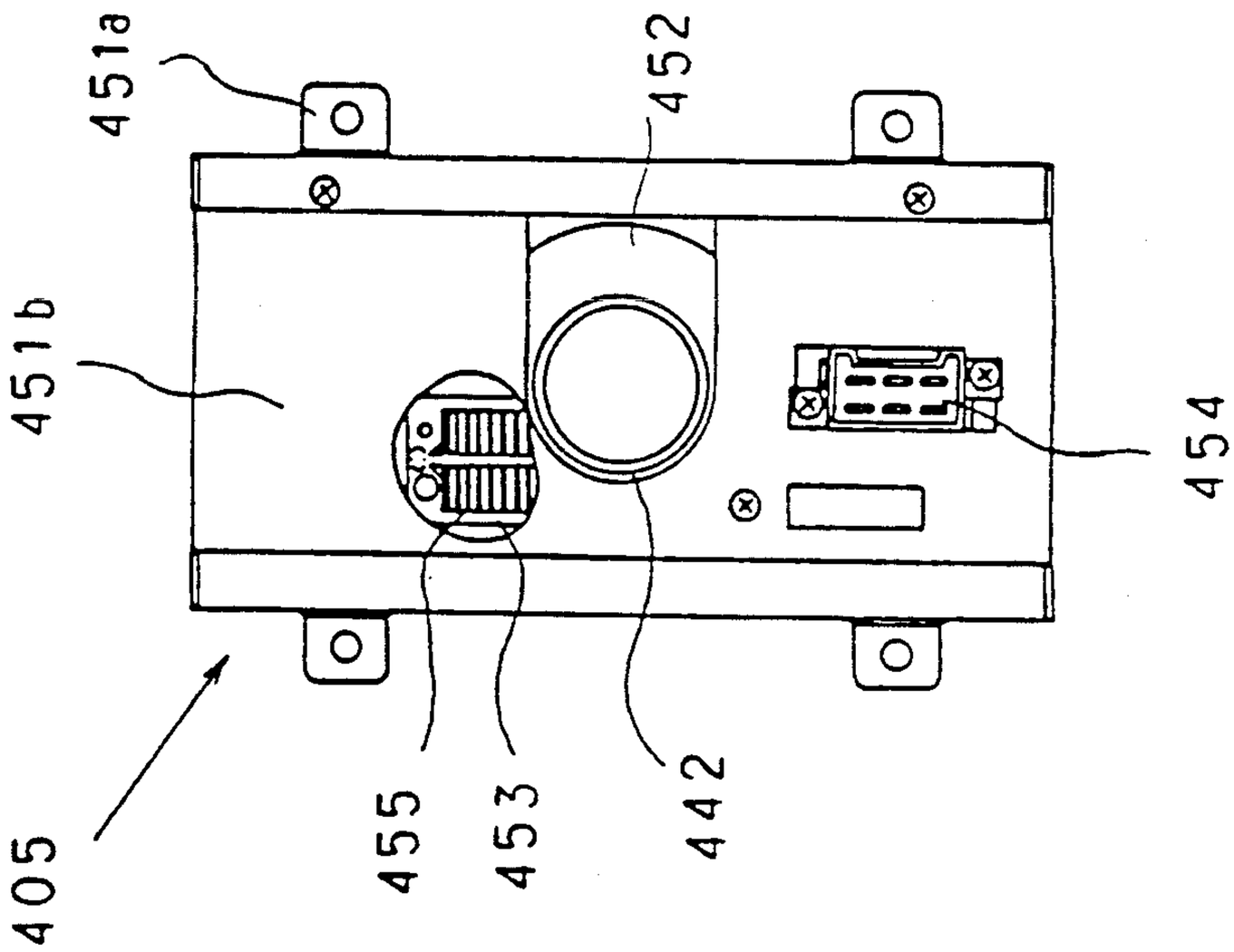

451a
452
451b
454
405
455
453
442

FIG. 73

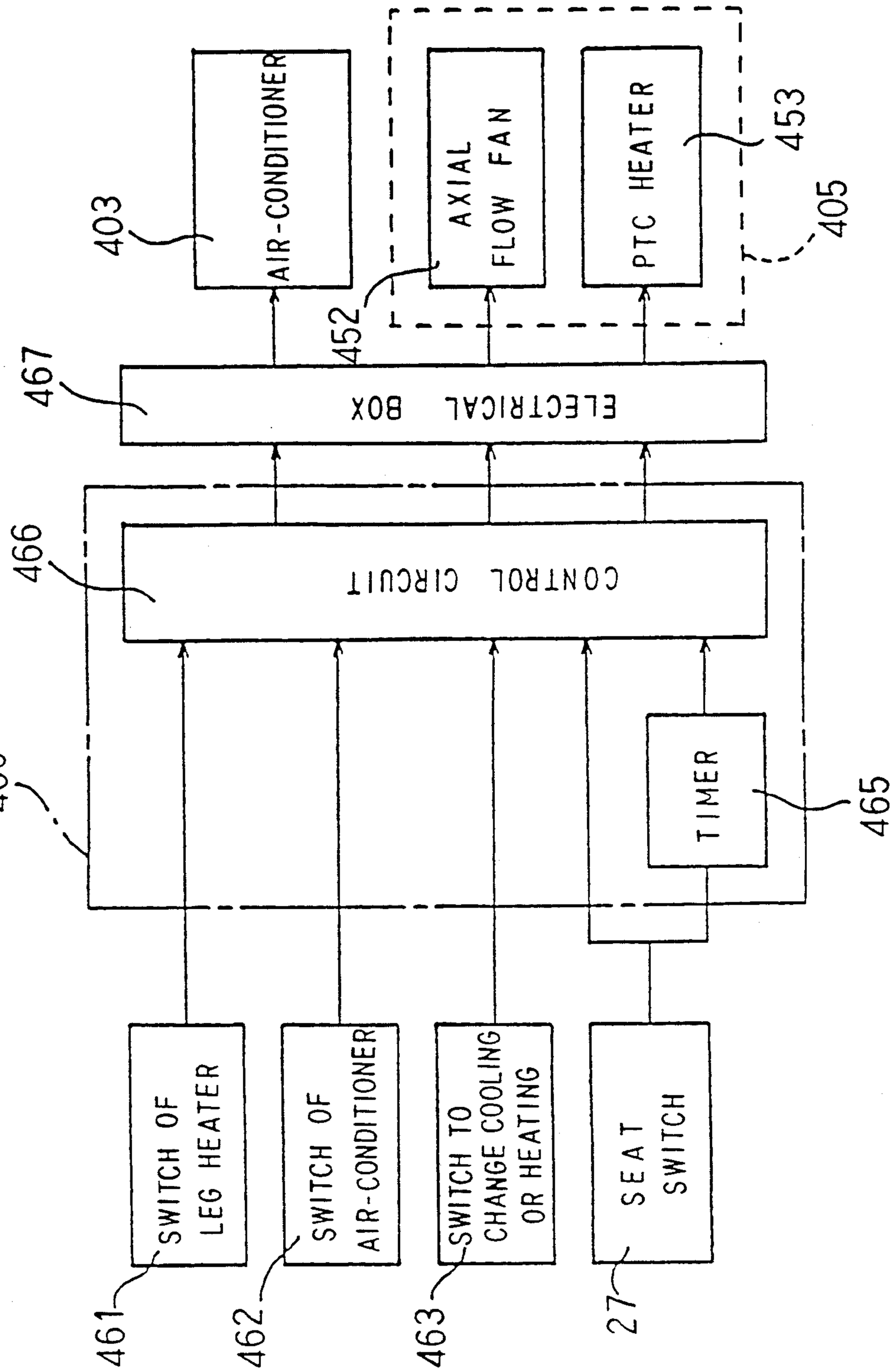

403
AIR-CONDITIONER
452
AXIAL FLOW FAN
PTC HEATER
453
405
467
ELECTRICAL BOX
466
CONTROL CIRCUIT
406
TIMER
465
461
SWITCH OF LEG HEATER
462
SWITCH OF AIR-CONDITIONER
463
SWITCH TO CHANGE COOLING OR HEATING
27
SEAT SWITCH

FIG. 74

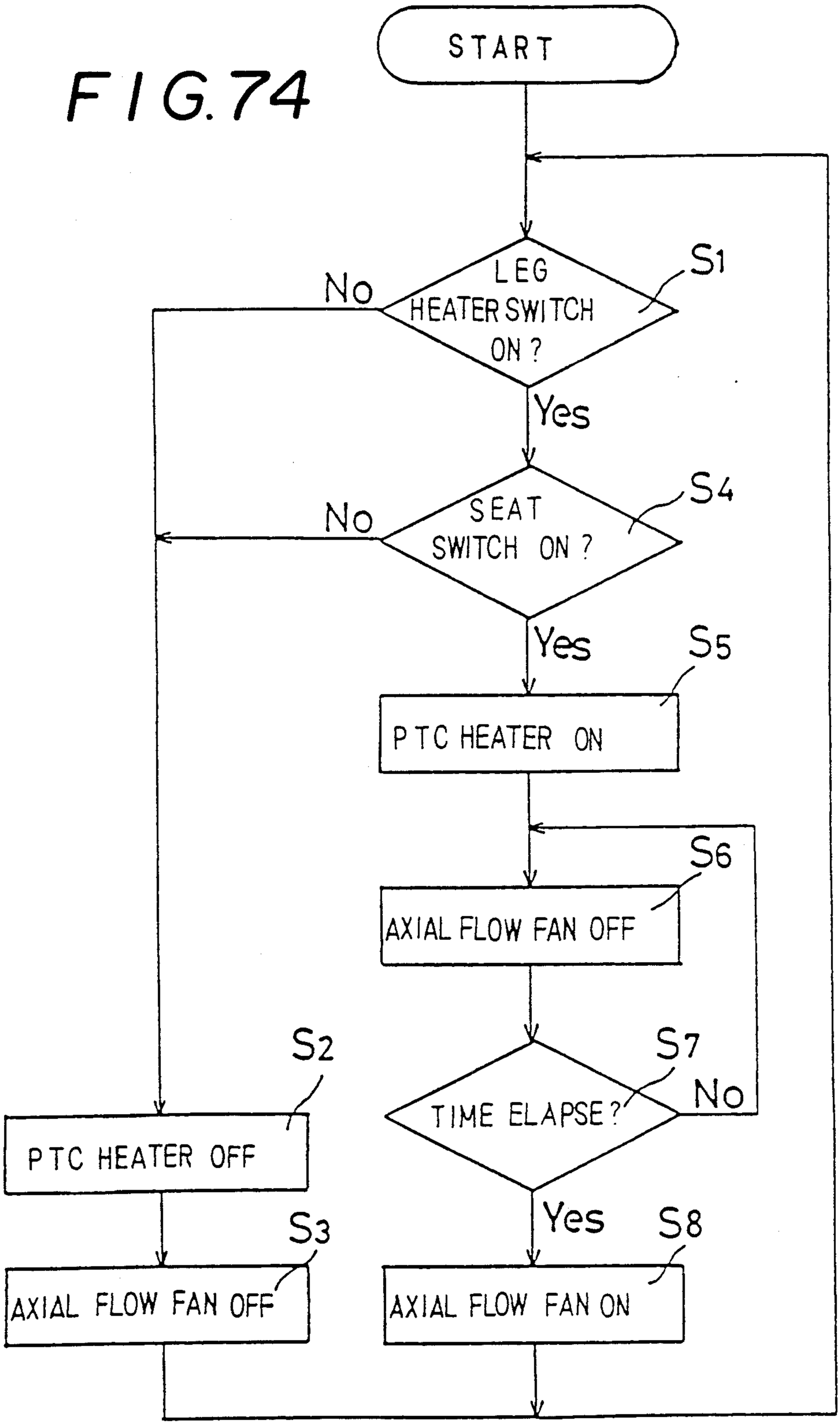

START
LEG HEATER SWITCH ON ?
S1
No
Yes
SEAT SWITCH ON ?
S4
No
Yes
S5
PTC HEATER ON
S6
AXIAL FLOW FAN OFF
S7
TIME ELAPSE?
No
Yes
S8
AXIAL FLOW FAN ON
S2
PTC HEATER OFF
S3
AXIAL FLOW FAN OFF

FIG.75

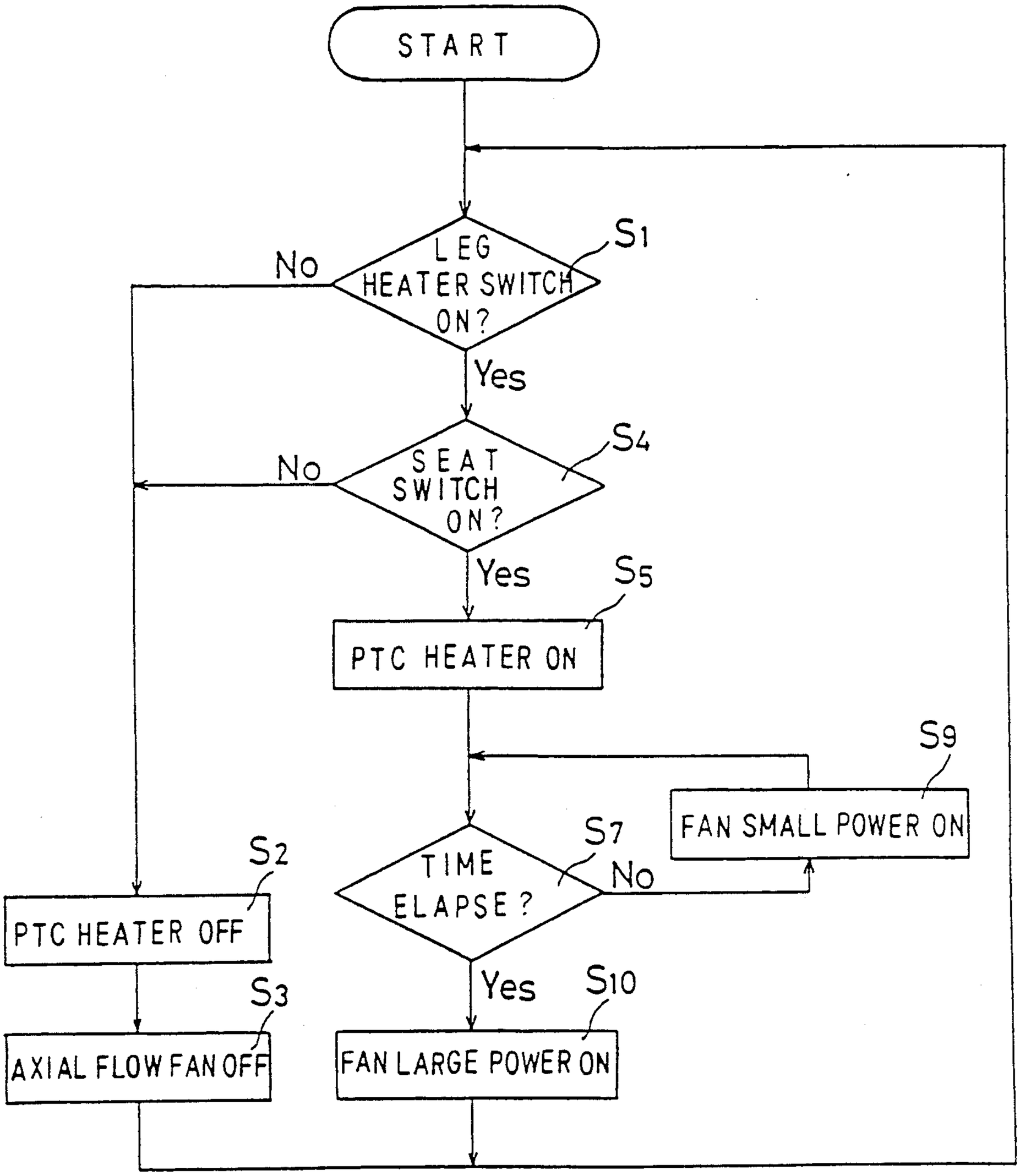

START
LEG HEATER SWITCH ON?
S1
No
Yes
SEAT SWITCH ON?
S4
No
Yes
S5
PTC HEATER ON
S9
FAN SMALL POWER ON
TIME ELAPSE?
S7
No
Yes
S10
FAN LARGE POWER ON
S2
PTC HEATER OFF
S3
AXIAL FLOW FAN OFF

FIG.76

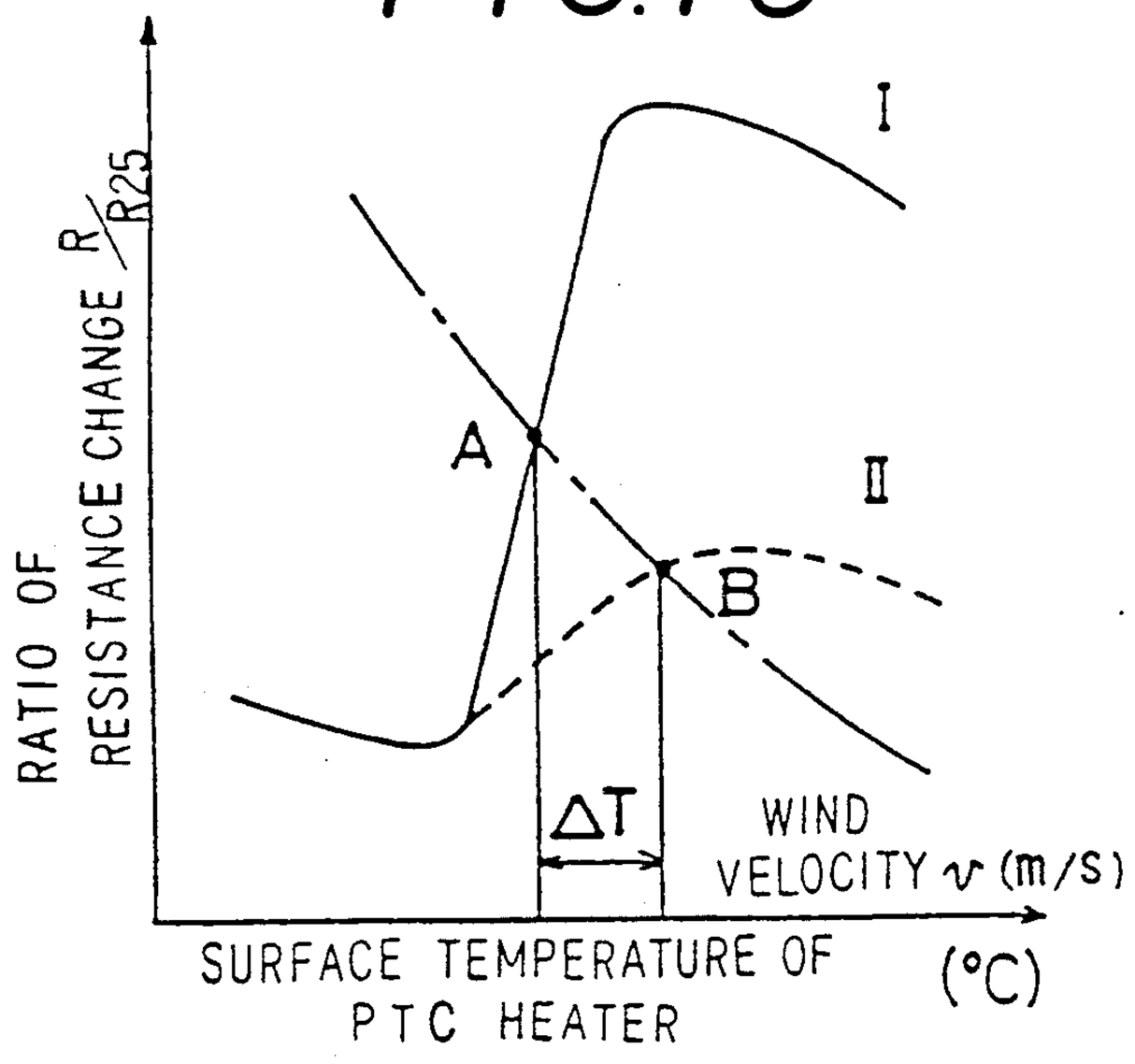

RATIO OF RESISTANCE CHANGE R/R25
I
II
A
B
ΔT
WIND VELOCITY v (m/s)
SURFACE TEMPERATURE OF PTC HEATER (°C)

FIG.78

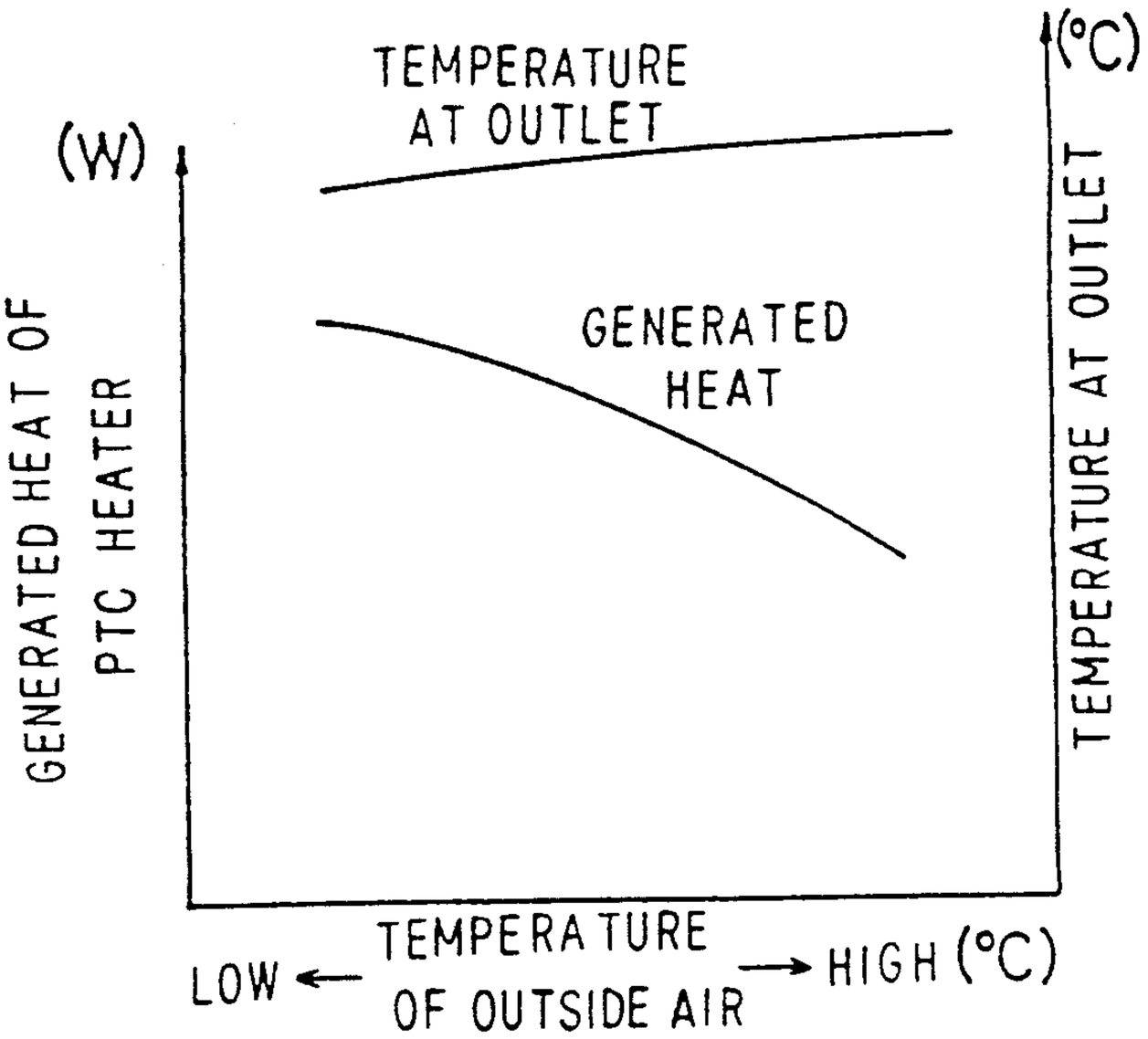

TEMPERATURE AT OUTLET
GENERATED HEAT
GENERATED HEAT OF PTC HEATER (W)
TEMPERATURE AT OUTLET (°C)
LOW ← TEMPERATURE OF OUTSIDE AIR → HIGH (°C)

FIG.77

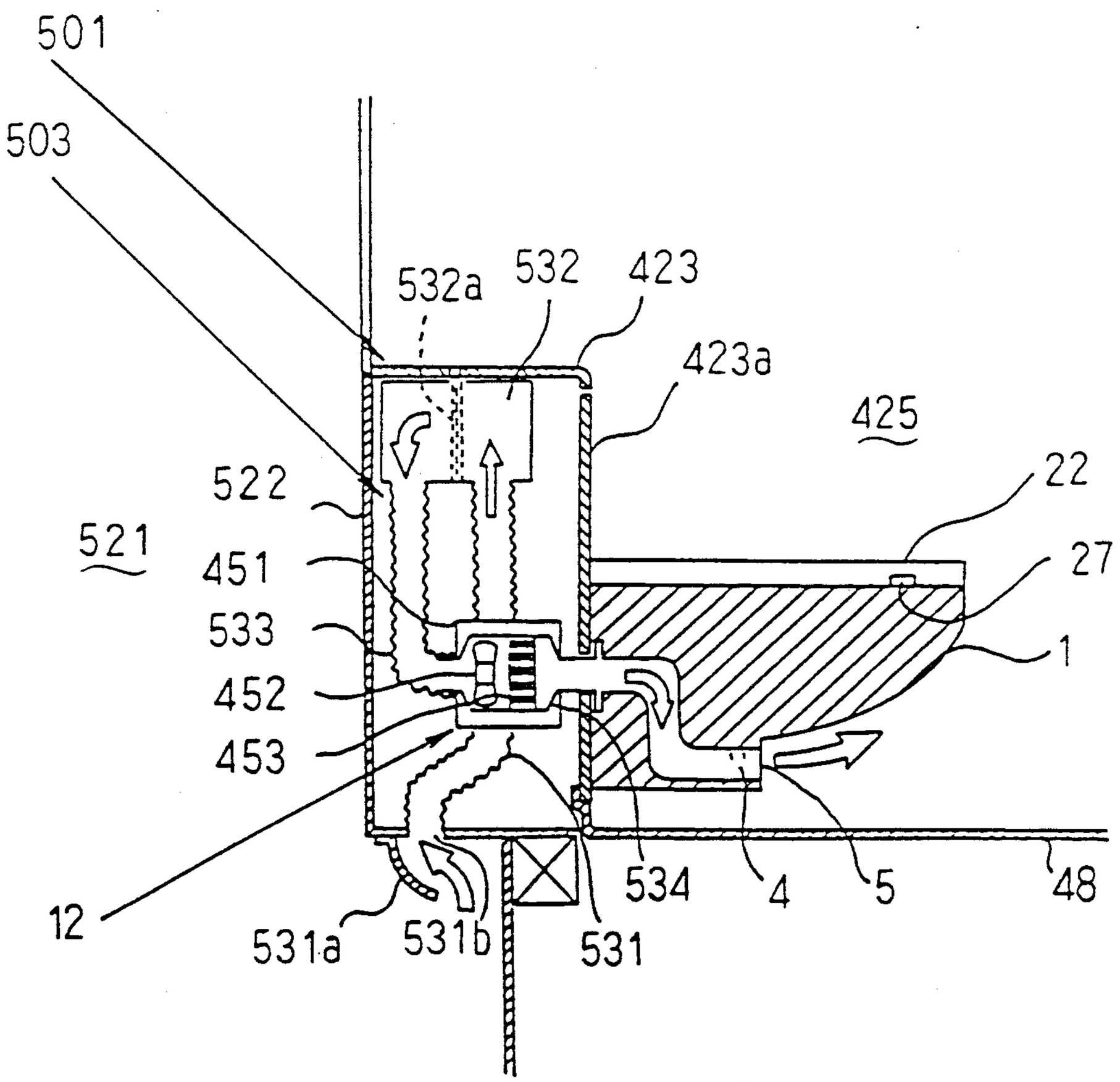

501
503
532a
532
423
423a
425
522
521
451
533
452
453
22
27
1
12
534
4
5
48
531a
531b
531

FIG. 79

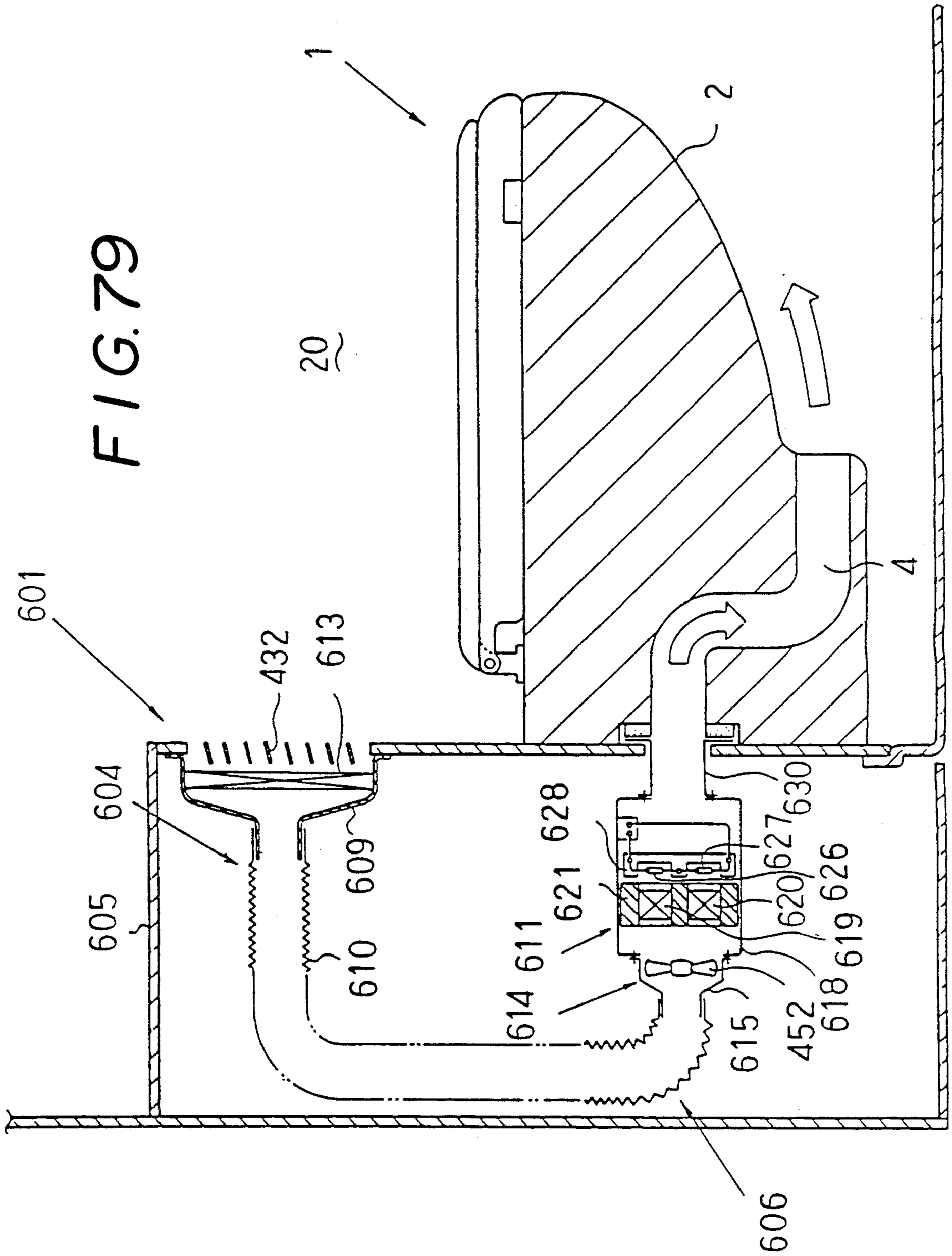

1
2
20
601
432
613
604
605
609
610
628
621
611
614
627
630
620
626
619
618
452
615
4
606

FIG.80

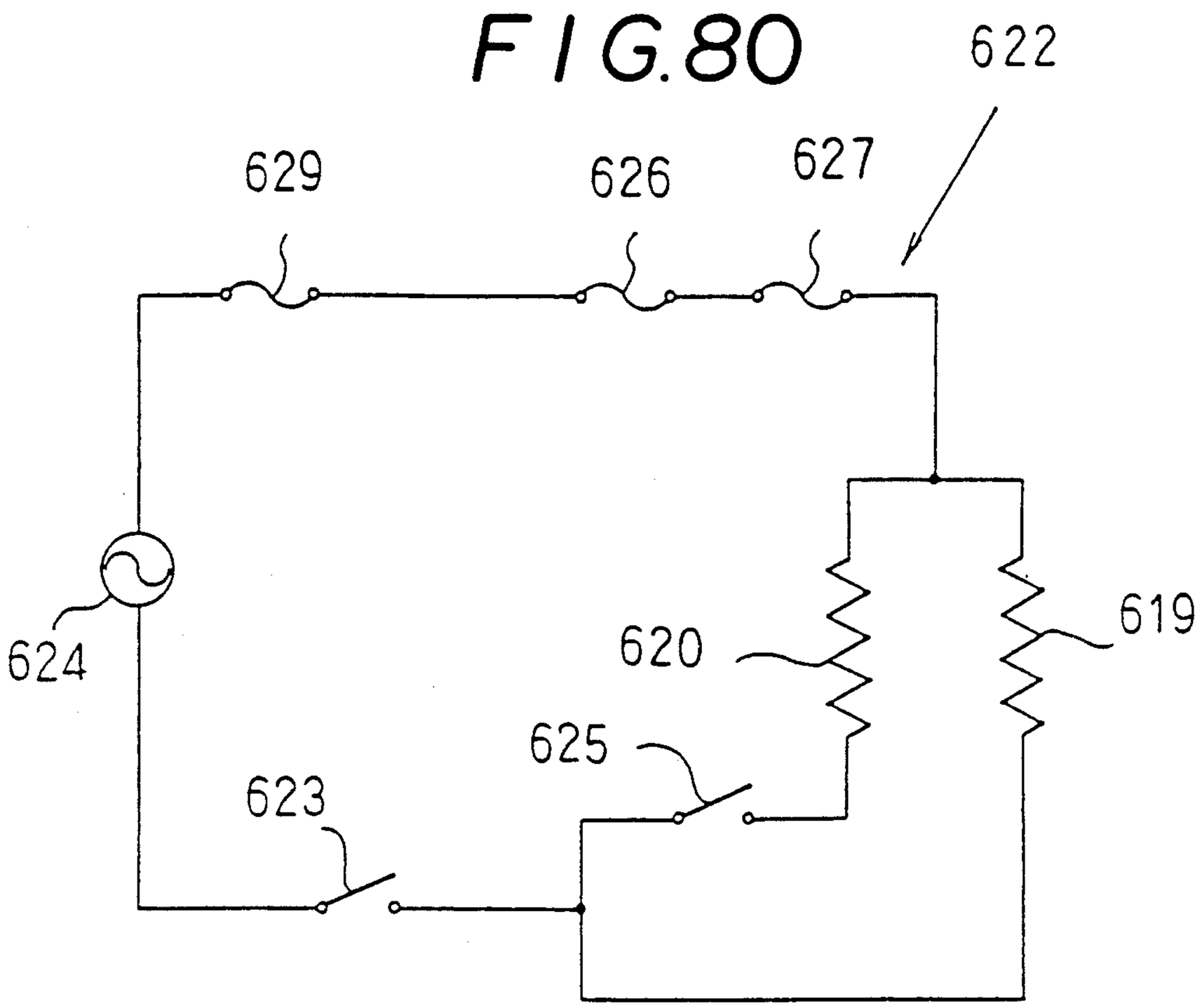

622
629
626
627
624
620
619
625
623

FIG.81

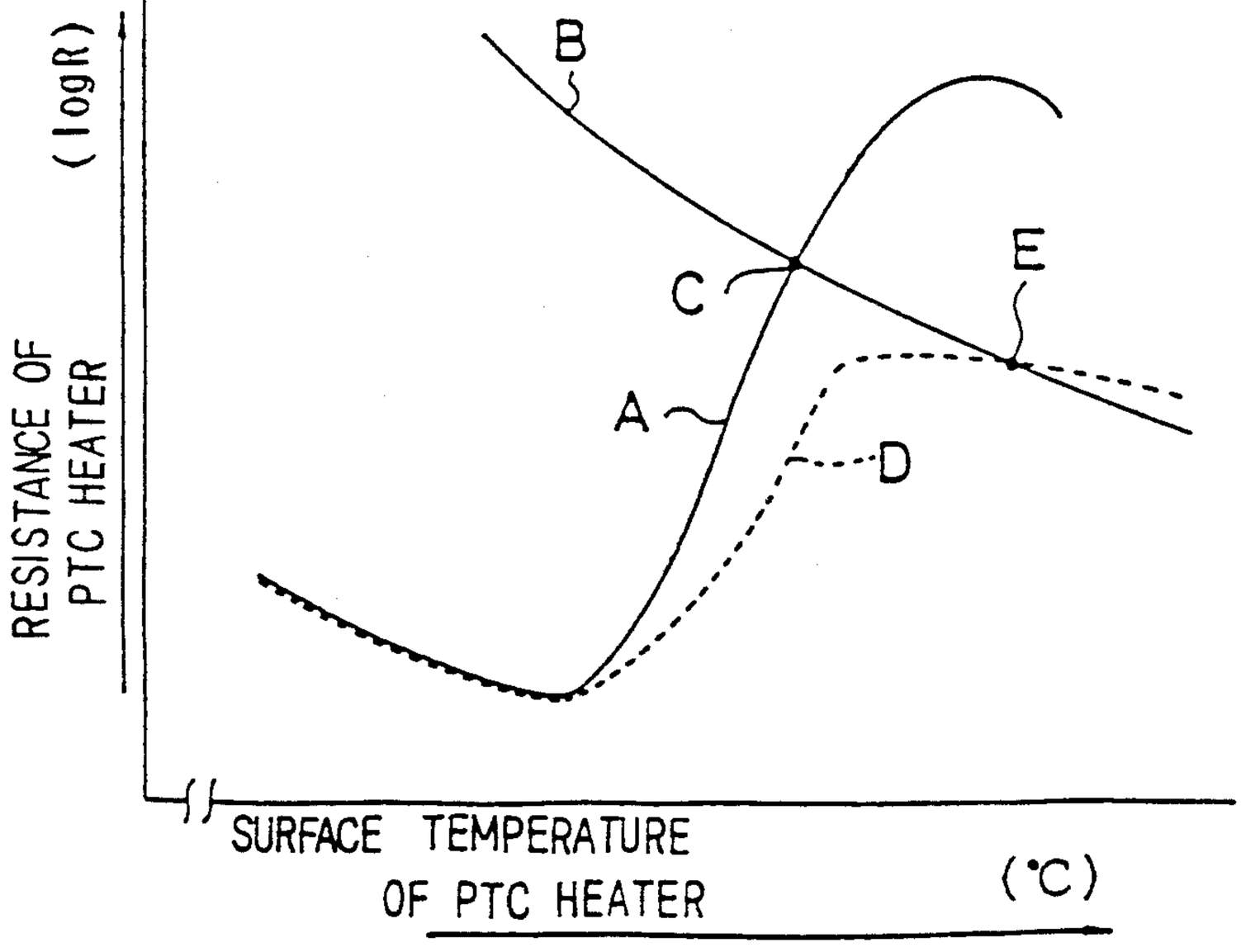

B
C
E
A
D
RESISTANCE OF PTC HEATER (logR)
SURFACE TEMPERATURE OF PTC HEATER (°C)

FIG.82

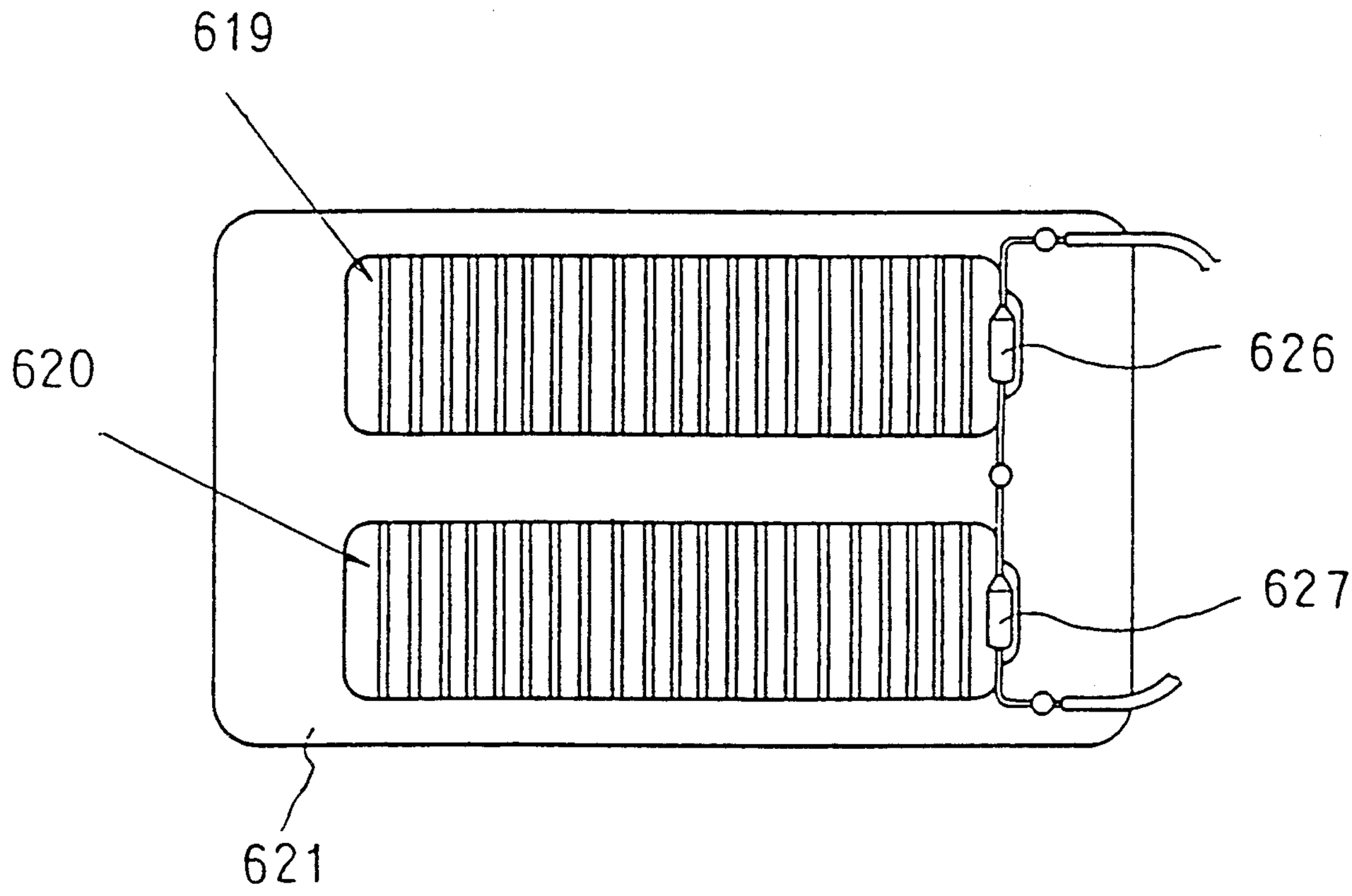


FIG.83

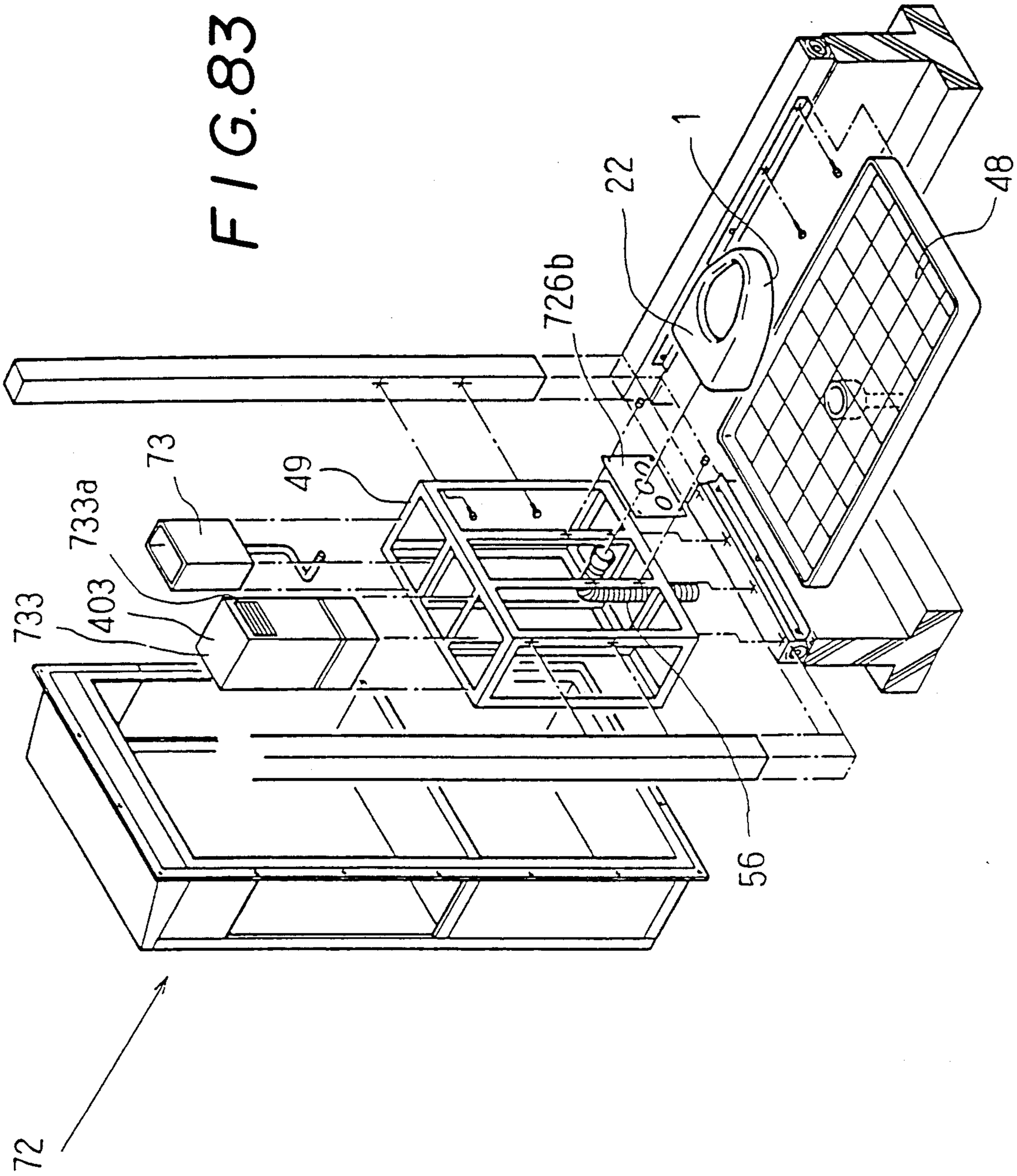
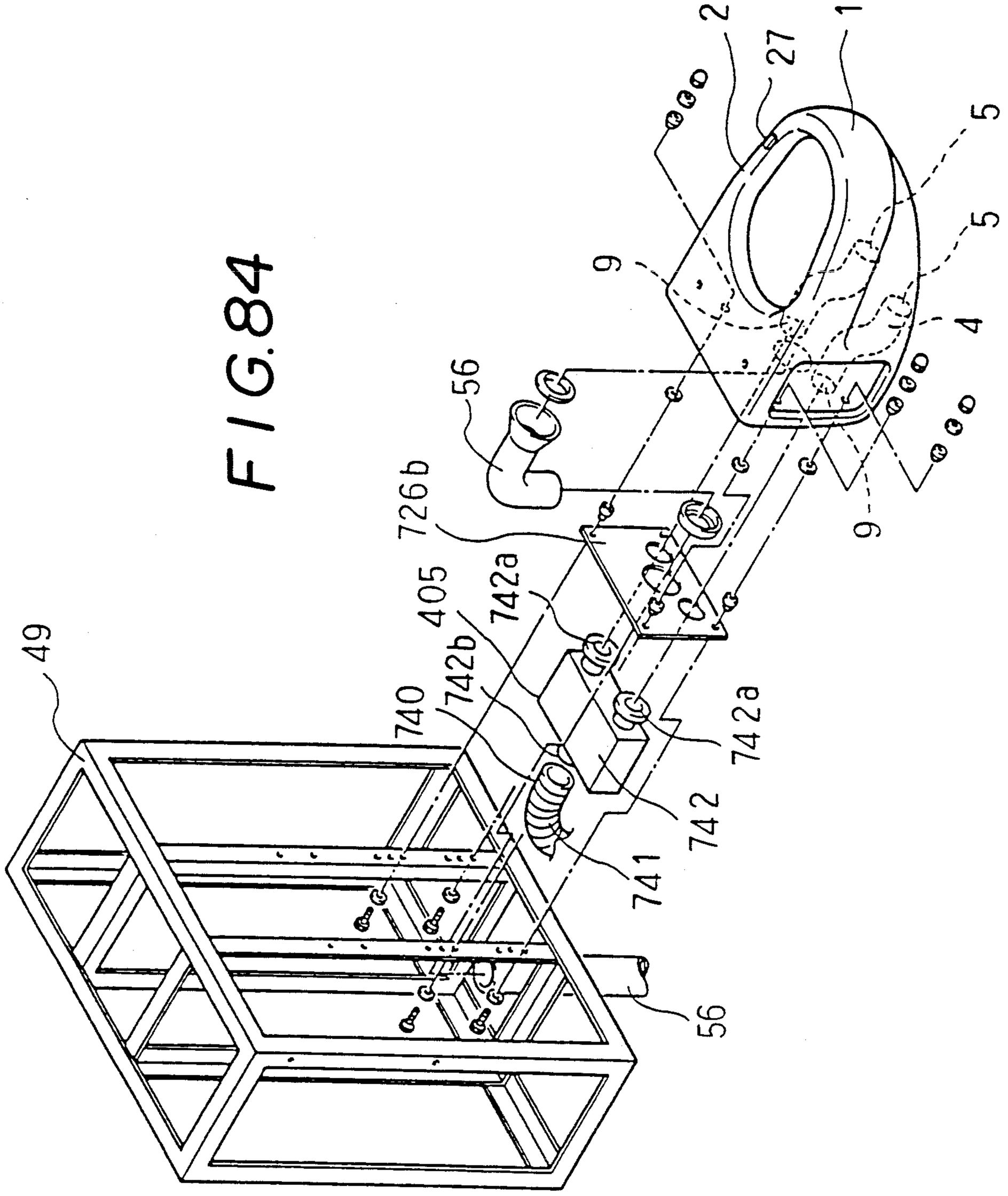


FIG.84



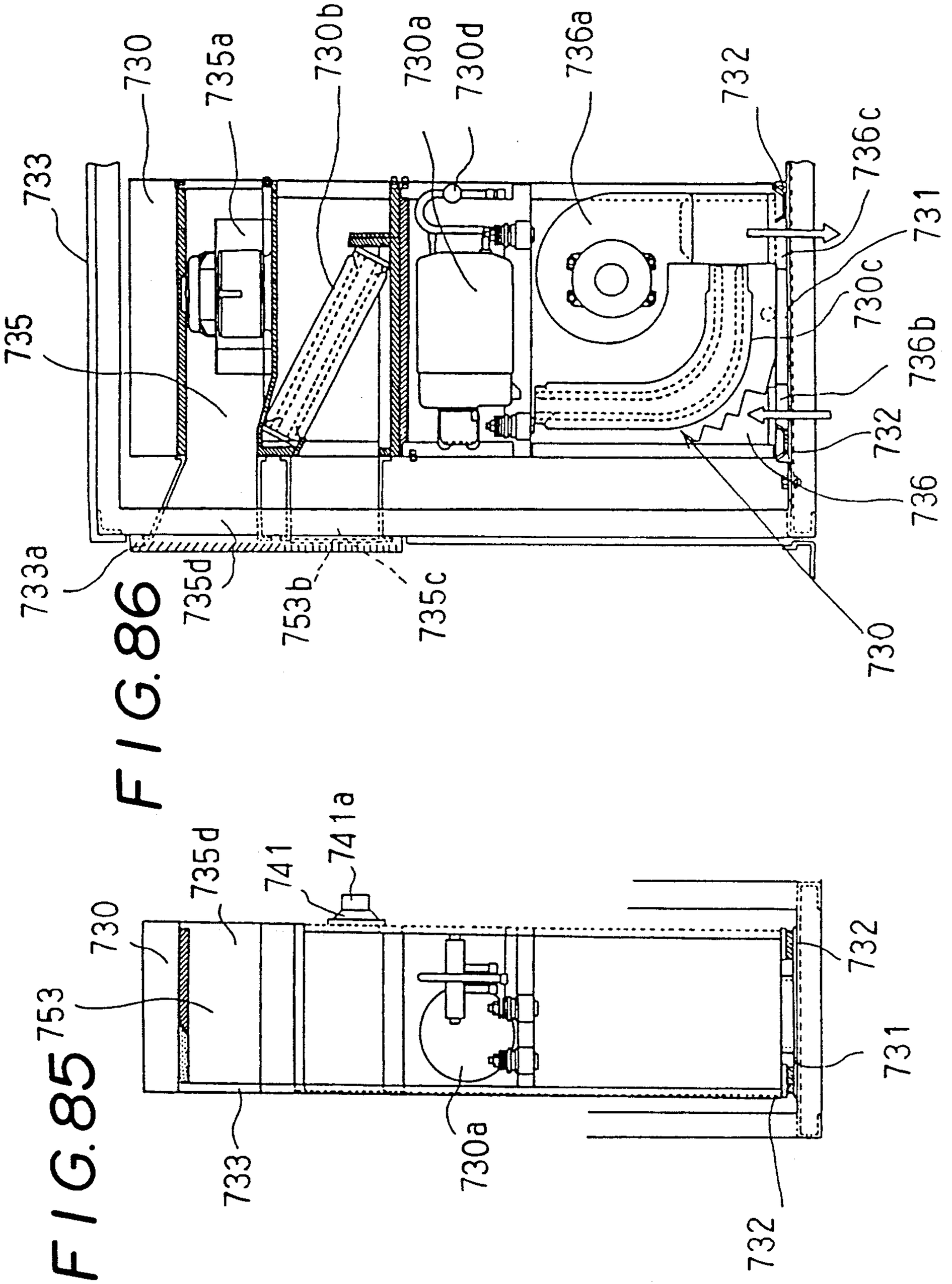

730
735a
730b
730a
730d
736a
732
736c
733
731
735
730c
736b
732
736
733a
735d
753b
735c
730
735d
741
741a
753
732
731
733
730a
732

FIG. 86

FIG. 85

WATER CLOSET BLOWING WARM AIR AND WATER CLOSET UNIT ATTACHABLE TO TOILET ROOM

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a sitting type water closet blowing warm air, and a water closet unit capable of attaching to a toilet room.

The term "sitting type water closet" used herein means a water closet utilized by sitting directly on a toilet seat thereof, and includes a bench type water closet (i.e, a water closet fixed on a side wall of a toilet room at a rear side of the water closet), a stool type water closet (i.e., a water closet mounted on a floor of the toilet room), a water closet fixed on the side wall and floor of the toilet room, and so on.

2. Description of the Related Art

A heatable toilet seat has become popular and thereby improves the user's feeling when a water closet is used. Recently, a portable electric heater is often furnished in the toilet room to wholly heat the room. Further, an air-conditioner such as a heat pump type air-conditioner is sometimes provided in the toilet room.

However, the toilet room can not be wholly heated by the heatable toilet seat.

The electric heater should be turned off for prevention of fire, when the toilet room is not used. The electric heater is not convenient to wholly heat the toilet room. There is a possibility to burn clothes of the user of the water closet, if the electric heater is too close. The heat is rapidly reduced, as the distance between the user and the heater is increased. When the toilet room is small, it is impossible to sufficiently separate the heater from the user. Thus, a power of the heater should be decreased, and a heating becomes unsufficient.

Although the air-conditioner, such as the heat-pump type air-conditioner, is used to wholly heat the toilet room, only the upper portion thereof is heated, but it is usually insufficient to heat the lower portion close to the leg of the user.

In Japan, there has been a recent increase in the number of houses in which so-called western-style water closet (i.e., sitting type water closet) is disposed instead of so-called Japanese-style water closet (i.e., a toilet tub in the form of a depression in the floor). The western-style water closet includes the bench type one. The western-style bench type water closet is disposed by attaching the same to the wall of the toilet room at the rear side of the water closet.

In the case of a concrete building, the western-style bench type water closet can be firmly attached to a front side wall of a counter which is mounted on the wall of the toilet room. In the case of an ordinary house, however, the wall is usually made of panels or wooden plates having a relatively low strength. Thus, the western-style bench type water closet can not be firmly attached to the wall.

SUMMARY OF THE INVENTION

The inventors of the present invention found that a heating can be effectively performed by applying warm air mainly to the leg of the user of the water closet. The inventors further completed an adapter which may firmly and easily attach the bench type water closet (which has a heating device using warm air), to the toilet room, even on the wall made of panels or wooden plates having a relatively low strength.

Accordingly, the object of the present invention is to provide a sitting type water closet having a means for applying warm air to the leg and the periphery thereof.

Another object of the present invention is to provide a water closet unit for attaching the sitting type water closet, particularly bench type water closet, having a means for applying warm air to the leg, to the side wall of the toilet room.

Other objects and advantages of the present invention will be apparent from the following description.

In accordance with the present invention, there is provided a sitting type water closet, comprising a toilet bowl, a warm air path for conveying warm air to a front portion of the bowl, and a warm air outlet disposed in a front portion of the bowl.

Further, in accordance with the present invention, there is also provided a water closet unit capable of the same attaching to a toilet room and blowing warm air out, comprising:

an adapter having a means for fixing the adapter to the toilet room, and a warm air generator;

and a sitting type water closet having a warm air duct for conveying warm air from the generator to a space in front of the water closet;

the bowl being attached at the rear portion thereof to the adapter.

The term "front" portion or "front" space as used herein with respect to the water closet or bowl means the direction which the face of the sitting user turns toward. Thus, the term "rear" as used herein means the direction which the back of the sitting user turns toward.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a side elevation view of a first embodiment of the water closet according to the present invention, FIG. **2** is a sectional view taken on line II—II of FIG. **3**, FIG. **3** is a front view of FIG. **1**, and FIG. **4** is a sectional view taken on line IV—IV of FIG. **1**.

FIG. **5** is a side elevation view of a second embodiment of the water closet of the present invention, and FIG. **6** is a front view of FIG. **5**.

FIG. **7** is a side elevation view of a third embodiment of the water closet according to the present invention, FIG. **8** is a sectional view taken on line VIII—VIII of FIG. **9**, and FIG. **10** is a sectional view taken on line X—X of FIG. **7**.

FIG. **11** is a side elevation view of a fourth embodiment of the water closet of the present invention, FIG. **12** is a front view of FIG. **11**, and FIG. **13** is a sectional view taken on line XIII—XIII of FIG. **11**.

FIG. **14** is a front view of a fifth embodiment of the water closet of the present invention, and FIG. **15** is a sectional view of FIG. **14**.

FIG. **16** is a front view of a sixth embodiment of the water closet of the present invention, and FIG. **17** is a sectional view thereof.

FIG. **18** is a front view of a seventh embodiment of the water closet of the present invention, and FIG. **19** is a sectional view thereof.

FIG. **20** is a front view of a eighth embodiment of the water closet of the present invention, and FIG. **21** is a sectional view thereof.

FIG. **22** is a side elevation view of a ninth embodiment of the water closet according to the present inven-

tion, FIG. **23** is a front view of FIG. **22** and FIG. **24** is a sectional view taken on line XXIV—XXIV of FIG. **22**.

FIG. **25** is a perspective view of a lower portion of another embodiment of the water closet of the present invention, FIG. **26** is a rear view of the water closet, FIG. **27** is a front view thereof, FIGS. **28**, **29** and **30** are sectional views taken on lines XXVIII—XXVIII, XXIX—XXIX and XXX—XXX of FIG. **27**, respectively, and FIGS. **31**, **32**, **33**, **34** and **35** are sectional views taken on lines XXXI—XXXI, XXXII—XXXII, XXXIII—XXXIII, XXXIV—XXXIV and XXXV—XXXV of FIG. **30**, respectively.

FIG. **36** is a sectional view of still another embodiment of the sitting type water closet according to the present invention.

FIG. **37** is a sectional side view of a first embodiment of the present water closet for preventing a trap water from freezing, FIG. **38** is a sectional view taken on line XXXVIII—XXXVIII of FIG. **37**.

FIGS. **39** and **40** are sectional views of another embodiment of the present water closet for preventing the trap water from freezing.

FIGS. **41** and **42** are side elevation views schematically illustrating a manner wherein the water closet unit according to the present invention is installed in the toilet room, FIG. **43** is a front view of the water closet shown in FIG. **42** as a sectional view, FIG. **44** is a sectional view taken on line XLIV—XLIV of FIG. **43**.

FIG. **45** is a sectional plan view illustrating a manner wherein the sitting type water closet unit is installed in the toilet room, FIGS. **46** and **47** are setting-up perspective views of the water closet unit.

FIG. **48** is a perspective view showing upwardly a lower portion of a structure fixing the warm air generator to the water closet.

FIG. **49** is a side elevation view schematically illustrating another manner wherein the sitting type water closet is installed in the toilet room.

FIGS. **50** and **51** are sectional plan views illustrating the manner wherein the water closet unit is installed in the toilet room, using a specific fixing plate, FIG. **52** is a setting-up perspective view of FIGS. **50** and **51**, FIGS. **53** and **54** are perspective views of the embodiments of the fixing plates.

FIG. **55** is a sectional elevation view schematically illustrating the manner wherein the present water closet unit including the warm air outlet disposed on the side wall of the adapter is installed in the toilet room, FIG. **56** is a sectional plan view thereof, FIG. **57** is a sectional view taken on line LVII—LVII of FIG. **56**, FIGS. **58** and **59** are setting-up perspective views thereof, and FIG. **60** is a perspective view of the water closet and the warm air generator.

FIG. **61** is a plan view of the seat switch, FIG. **62** is a front view thereof, FIG. **63** is a sectional view thereof, FIG. **64** is a block diagram of the control system of the embodiment wherein the seat switch is used, FIGS. **65** and **66** are flow charts thereof, and FIG. **67** is a time chart thereof.

FIGS. **68** and **69** are side elevation views and FIG. **70** is a perspective view schematically illustrating the manner wherein the water closet unit having the seat switch as another embodiment of the present invention is installed in the toilet room, FIG. **71** is a side elevation view of a leg heater, FIG. **72** is a plan view thereof, FIG. **73** is a block diagram of the built-in control circuit of the control panel, FIG. **74** is a flow chart of another actuation of the leg heater in the control circuit, and FIG. **75** is a flow chart of still another actuation of the leg heater in the control circuit.

FIG. **76** is a graph showing the relationship between the surface temperature of a positive thermistor cell (hereinafter referred to as PTC) heater and a ratio of resistance at a given temperature to that at 25° C., FIG. **77** is a sectional elevation view schematically illustrating the manner wherein the water closet unit using an intake vent for the outside air is installed in the toilet room, and FIG. **78** is a graph showing the relationship between the temperature of the outside air, and a heat release value and the temperature at the outlet.

FIG. **79** is a sectional elevation view illustrating the manner wherein the water closet unit containing a safety means as an embodiment of the present invention is installed in the toilet room, FIG. **80** is an electrical circuit diagram of an on-off control of a first PTC heater and a second PTC heater, FIG. **81** is a graph showing the relationship between the temperature of the PTC heater and the resistance, FIG. **82** illustrates the manner disposing temperature fuses.

FIG. **83** illustrates the setting-up of the main part of an embodiment of the present invention wherein a wholly heating device is further disposed, FIG. **84** shows an enlargement of the main part in FIG. **83**, FIG. **85** is a front view of an air-conditioner, and FIG. **86** is a sectional elevation view thereof.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The preferred embodiments of the sitting type water closet according to the present invention will be explained hereinafter.

The sitting type water closet of the present invention has a warm air path (comprising a warm air duct, and optionally a warm air guiding groove) so that warm air may be blown out from the front portion of the water closet.

In the water closet according to the present invention, the warm air is blown out from the front portion thereof, and thus, the user can be heated mainly around the leg. Because the heating is carried out with the warm air, there is no possibility to burn the clothes. If the warm air continues to be blown out when the toilet room is not used, it is possible to wholly heat the room. Therefore, the water closet may be very comfortably employed, particularly in a low temperature season, e.g., winter. During a humid season, e.g., the rainy season, it is possible to avoid dew condensation on the water closet by blowing the warm air out.

Typical embodiments of the present invention will be explained hereinafter referring to the drawings.

FIGS. **1** to **4** show a first embodiment of the present invention. The western-style bench type water closet **1** is attached to the side wall of the toilet room or the like at the rear side 1a of the closet. A toilet bowl **2** is provided to the front portion of the closet **1**, and a rim water conduit **3** is provided to the upper portion of the bowl **2**, surrounding the bowl **2**. In the water closet **1**, the warm air duct **4**A is disposed integrally with the bowl **2**, extending longitudinally, i.e., from the rear portion of the bowl to the front portion of the bowl. The warm air duct **4**A is ended at the front portion of the bowl **2** to form a warm air outlet **5**. The other end of the warm air duct **4**A is open at the rear side **1***a* of the water closet **1**. The water closet **1** further contains a trap **6** and a drainage hole **7**.

The water closet according to the above embodiment can blow the warm air out from the outlet **5**, by disposing a warm air generator (refer to FIG. **25**, etc.) connected with the warm air duct **4A**. The warm air blown from the outlet touches a lower half of the user's body, particularly a calf, to thereby heat the user. Because the heating is carried out with the warm air, the clothes are not burnt. If the warm air is blown out even when the water closet is not employed, the toilet room may be wholly heated.

FIGS. **5** and **6** show a second embodiment of the present invention. In the water closet **1** of this embodiment, the outlet **5** is disposed at the position higher than that of the above embodiment shown in FIGS. **1** to **4**. The warm air duct **4A** is also disposed at the front portion of the bowl **2**, diagonally upwardly extending from the rear portion to the front portion. Therefore, the warm air is blown out diagonally upwardly, and thus, the upper part in the leg of the user is heated.

FIGS. **7** to **10** show a third embodiment of the present invention. In the water closet **1** of this embodiment, the warm air duct **4A** is disposed along the upper periphery of the bowl **2**. As shown in FIGS. **8** and **10**, the warm air duct **4A** surrounds the outer periphery of the rim water conduit **3**, at the front portion of the toilet bowl **2**. The outlet **5** is formed in the form of opening disposed in the bottom wall of the warm air duct **4A** at the front portion of the bowl **2**. In the embodiment as shown, three outlets are disposed, although any number of the outlets **5** may be formed.

FIGS. **11** to **13** illustrate a fourth embodiment of the present invention. In this embodiment, the warm air duct **4B** formed separately from the bowl **2** is disposed along the bottom surface of the bowl **2**, extending longitudinally, i.e., from the rear portion of the bowl to the front portion of the bowl. The outlet **5** is formed at the end of the duct **4B**. In this embodiment, a cover **15** for the bowl **2** is arranged. The duct **4B** is disposed in a space between the cover **15** and trap **6**.

FIGS. **14** and **15** show the water closet **1** corresponding to fifth embodiment of the present invention. This embodiment is different from the above fourth embodiment with respect to the fact that the cover for the bowl **2** is not provided, and thus, the warm air duct **4B** is exposed.

In the fourth and fifth embodiments as shown in FIGS. **11** to **15**, the warm air duct **4B** can be attached to the water closet without changing the conventional shape of the closet per se. Thus, the water closet can be easily manufactured.

FIGS. **16** and **17** show the water closet as a sixth embodiment of the present invention. The water closet **1** of this embodiment corresponds to the water closet wherein the cover **16** for the warm air duct is arranged in the water closet of the embodiment as shown in FIGS. **14** and **15**. The cover **16** can be attached with, for example, an adhesive. The water closet of this embodiment can also be easily manufactured without changing the conventional shape of the water closet. Further, the cover **16** brings about a good appearance.

FIGS. **18** and **19** illustrate the water closet **1** as a seventh embodiment of the present invention. In the water closet **1** of this embodiment, a wall **17** is arranged to form the warm air duct **4A** with the bowl cover **15**, trap **6**, the bottom surface of the bowl **2** and the wall **17**.

FIGS. **20** and **21** show the water closet **1** as a eighth embodiment of the present invention. In this embodiment, the warm air duct **4B** is attached to the water closet **1** with a rubber sucker **18**. Thus, the duct **4B** can be easily attached to and removed from the closet **1**.

FIGS. **22** to **24** show the water closet **1** as a ninth embodiment of the present invention. In this embodiment, the warm air duct **4A** formed integrally with the water closet **1** is disposed, longitudinally extending to the lower portion of the bowl. From the outlet **5** to the tip of the bowl, a warm air guiding groove **8** which does not have a bottom wall is disposed, extending to the tip of the bowl so as to guide the warm air toward the upper portion of the leg of the user. In the sitting type water closet of the above embodiment, the outlet at the end of the warm air duct is disposed backwardly in a given distance from the tip of the bowl. Therefore, if urine (particularly, when discharged from a standing male user) splashed on the front outer surface of the toilet bowl or washing water (hereinafter referred to as "foul water") runs down to the outlet, the foul water is prevented from entering into the warm air duct. Therefore, it may be avoided that the foul water dries up in the warm air duct and becomes a source of a malodor. Even if the dried foul water is bonded to the ceiling or the side wall in the warm air duct, it may be easily removed by wiping.

As described, the warm air duct may be formed integrally with the toilet bowl. Alternatively, the duct may be formed separately from the bowl, and then attached thereto.

In a preferred embodiment of the present invention, at least a terminal portion of the warm air duct extends on the lower portion of the toilet bowl in a direction of the front portion of the bowl, and the warm air outlet at the end of the duct is disposed backwardly in a given distance in a direction of the rear portion of the bowl from the front portion. Further, the warm air guiding groove extends on the lower outside of the bowl from the warm air outlet to the front portion of the bowl, to thereby convey the warm air from the outlet to the front space of the water closet. Furthermore, a width of the groove is gradually broadened toward the front portion of the bowl, at least around a downstream area of the groove.

In the sitting type water closet of this embodiment, the disadvantages caused by the foul water splashed to the outside of the front portion of the bowl can be avoided, because the warm air outlet at the end of the warm air duct is disposed backwardly in a given distance in the direction of the rear portion of the bowl from the front portion thereof. Further, the water closet of this embodiment has the groove which guides the warm air blown out from the outlet of the warm air duct, and is broadened in the direction of the front portion of the bowl. Therefore, the warm air is blown out at the wide angle. Thus, the water closet of this embodiment can certainly heat the lower half of the user, particularly the calf, independently of the figure of the leg of the user, e.g., O-shaped or X-shaped shank.

The present water closet which contains the warm air path comprising the warm air duct **4** and the warm air guiding groove **8** having a specific structure is illustrated in FIGS. **25** to **35**.

The sitting type water closet **1** shown in FIG. **25** is a bench type one, and attached to the wall of the toilet room or the like at the rear side **1***a*. The water closet **1** contains the toilet bowl **2** in the front portion, and the rim water conduit **3** is disposed in the upper portion of the bowl **2**, surrounding the bowl **2** (refer to FIGS. **26** to **30**. etc.). In the bench type water closet **1**, a pair of the

warm air ducts **4** is disposed integrally with the toilet bowl **2**, longitudinally extending along the curved surface of the lower portion of the bowl **2**. The warm air duct **4** has an opening, i.e., the warm air outlet **5** which is set back in a given distance (at the position slightly forward from the trap **6** in this embodiment as shown) in the direction of the rear portion from the front portion of the bowl (refer to FIG. **28**). The other end of the warm air duct **4** is an opening **9** on the rear side la of the water closet **1** (refer to FIGS. **26** and **28**). The groove **8** is disposed from the outlet **5** on the front and lower portion of the bowl **2**, and may guide the warm air from the outlet **5** to the front space of the water closet **1**.

As shown in FIGS. **25** to **28**, the width of the groove **8** is rarely or not changed in a portion B between the outlet **5** and an intermediate point A. However, the width is gradually broadened in a front portion C beginning from the intermediate point A to the front portion of the water closet **1**.

The water closet **1** shown in FIG. **25** has the drainage hole **7**, holes **10** for the bolts to attach the water closet **1** to the wall of the toilet room or the like, holes **11** for the bolts to attach the toilet seat (refer to FIG. **41** etc.), and a water supply inlet **13** (refer to FIG. **26**, etc.), and the like.

As shown in FIG. **25**, the rear end opening **9** of the warm air duct **4** is connected with, for example, the warm air generator **12**, to supply the warm air to the warm air duct.

In the sitting type water closet **1** having the above structure, the warm air from the warm air generator **12** is emitted from the outlet **5**, driven along the guiding groove **8**, and widely blown out from the tip of the groove **8**, whereby the lower half of the body, particularly the calf, of the user of the water closet **1** is heated with the warm air.

Although the width of the guiding groove **8** is gradually broadened in the front portion C from the intermediate position A in the embodiment shown in the above figures (particularly, FIG. **28**), the width may be gradually broadened immediately after the outlet **5**. To avoid an internal focusing of the warm air blown out from the tip D of the water closet, the direction of the groove **8** is biased to the center of the bowl in the portion B between the outlet **5** and the intermediate position A, as shown in FIG. **28**.

In the embodiment as shown in FIGS. **25** to **35**, the width of the groove **8** is preferably about 50 to 100 mm at the downstream mouth of the groove **8** (i.e., the position shown with the arrow D in FIG. **28**) where the warm air leaves from the water closet **1**, when the width of the outlet **5** is about 40 mm, and a widening angle **0** at the downstream mouth of the groove **8** is preferably about 5 ° to 20° (refer to FIG. **28**).

Although the embodiment shown in FIGS. **25** to **35** is the bench type water closet, the present invention may be applied to various water closets, such as the stool type water closet, or the water closet installed on the floor and fixed on the wall of the toilet room.

According to the preferred embodiment of the present invention, the warm air duct has a horizontal or downstreamly downgrade slope around the warm air outlet. In this embodiment, the foul water is not introduced into the warm air duct, even if the foul water reaches to the warm air outlet. Therefore, it is prevented that the foul water is dried up in the warm air duct **4** and becomes the source of the malodor. For example, as shown in FIG. **36**, the warm air duct **4** has a horizontal or downgrade slope in a direction of the outlet **5** from the rear opening **9**. In the embodiment as illustrated, the slope is horizontal in the portion **4***a* near to the outlet **5**. The portion **4***a* may be downgrade. Alternatively, the slope of the warm air duct **4** may be horizontal or downgrade as a whole. Further, as shown in FIG. **36**, a raised portion **8***a* for protection against water may be disposed on the roof and/or the side wall of the groove **8**, thereby preventing the foul water from approaching the outlet **5**.

In still another embodiment of the sitting type water closet according to the present invention, the warm air path (comprising the warm air duct and the guiding groove) shares at least a part of the wall thereof with at least a part of the wall contacting the level surface of a sink water in the toilet bowl. The warm air passing through the warm air path can heat the trap water at the level surface thereof, thereby preventing the trap water from freezing, particularly in a cold district. The freezing of the trap water begins from the surface thereof. Therefore, the freezing of the trap water may be avoided by heating the water around the level surface thereof in the toilet bowl in the water closet according to this embodiment.

FIGS. **37** and **38** illustrate a first embodiment of the water closet for preventing the trap water from freezing. The water closet **1** shown in FIGS. **37** and **38** is a bench type closet, and attached to the wall of the toilet room or the like at the rear side la. The referential numerals in FIGS. **37** and **38** have the same meanings as given in FIG. **1** and the like.

As shown in FIG. **38**, the warm air duct **4** shares the wall thereof with that of the toilet bowl **2** on the right and left sides thereof, whereby the warm air passing through the warm air duct **4** directly heat the toilet bowl **2**, particularly around the level surface L of the trap water W. Therefore, the freezing of the trap water may be avoided.

FIGS. **39** and **40** illustrate another embodiment of the water closet for preventing the trap water from freezing. The warm air path in the bench type water closet **1** of this embodiment comprises the warm air duct **4** and the guiding groove **8**. As shown particularly in FIG. **39**, the guiding groove **8** shares the upper wall **8***b* thereof with the bottom wall of the toilet bowl **2**, whereby the warm air in the guiding groove **8** directly contacts the bowl surface opposite to the trap water W around the level L.

It should be understood that the detailed description with reference to FIGS. **1** to **40** is given by way of illustration only. For example, the number of the warm air outlet, the direction of blowing the warm air out or the like may be different from those shown in FIGS. **1** to **40**. The warm air path may have, for example, the sectional profile as shown in FIG. **40**. Further, the water closet may be not only the bench type, but also the stool type or the like.

The present invention also relates to a water closet unit containing an adapter which can attach the sitting type water closet having the warm air path to the wall of the toilet room.

The water closet unit according to the present invention may blow the warm air out from the front portion thereof, thereby heating the leg of the user. Since the heating is effected with the warm air, the clothes are not burnt.

By using the water closet unit according to the present invention, the bench type water closet is attached to

the wall of the toilet room with the adapter, and thus, the fixing strength may be extremely improved, even if the wall of the toilet room is made of a material having a weak strength, such as a wooden plate.

FIGS. **41** to **44** schematically illustrate the water closet unit according to the present invention. The sitting type water closet **1** is a bench type one, and attached at the rear side la thereof to the adapter **49** installed in the wall portion of the toilet room **20**. The rim water conduit **3** is disposed around the upper portion of the toilet bowl **2** (FIG. **42**). In the water closet **1**, the warm air duct **4** composing the warm air path **14** is longitudinally disposed at the side portion thereof, formed integrally with the toilet bowl. The end of the warm air duct **4** is an opening, i.e., the outlet **5**, at the tip of the water closet **1**. The rear end of the warm air duct **4** is an opening at the rear side la of the water closet **1**. The water closet **1** has the trap **6** and the drainge hole **7**.

A toilet seat **22** and a toilet cover **23** are disposed on the upper portion of the water closet **1** in a manner that the closet can be opened and closed with the seat and the cover. The toilet seat **22** and the toilet cover **23** are rotatably fixed with a hinge shaft **25** to a case **24** mounted on the upper rear portion of the water closet **1**. The bottom surface of the toilet seat **22** has rubber protuberances **26**.

In the embodiment as shown, the hinge shaft **25** may be moved up and down with a slight stroke. Further, a seat switch **27** including a pressure-sensitive switching mechanism may be disposed between the upper surface of the toilet bowl **2** and the hinge shaft **25**.

The seat switch **27** is connected via a lead wire **28** to a controller **29** installed in the wall **21** of the adapter or the toilet room. The controller **29** is connected through a signal wire **30** to the warm air generator **12**. The outlet **32** of the generator **12** is connected to the warm air duct **4**.

In the water closet **1** having the above structure, when the user sits down on the toilet seat **22**, the seat switch **27** is turned on, the warm air generator **12** is actuated, and then, the warm air is blown out from the outlet **5**. The warm air contacts and heats the lower half, particularly the calf, of the user. Because the warm air is blown out shortly after the actuation of the warm air generator **12**, the water closet has a good starting performance, and thus provides a comfortable heating. The on-off control of the warm air generator may be carried out, using means other than the seat switch.

The water closet unit of this embodiment will be explained in detail, referring to FIGS. **45** to **48**.

As shown in FIG. **45**, there are four pillars **41**, **42**, **43**, **44** at four corners in the toilet room **20**. Sleepers **45** and foundations **46** are arranged between the pillars, and the foundations **46** are arranged on pedestals **47** (FIGS. **45** and **46**). Metallic fixtures **48***a* having an L-letter shaped sectional profile are fastened with screws to the side walls of the spleepers **45** and foundations **46**. A waterproof pan **48** is held on the metallic fixture **48***a* and composes a floor of the toilet room **20**. Between the pillars **41** and **42**, there is installed the adapter **49** comprising a box-like structural frame. The frame type adapter **49** comprises twelve main angle bars **50** corresponding to twelve edges of a rectangular parallelepiped, and sub-angle bars **51** spanning the main angle bars **50**. Plural bolt holes **52** are vertically provided in the sub-angle bars **51***a* facing the toilet room. The bench type water closet **1** is attached to the adapter **49** with bolts **53** through the bolt holes **52**.

The water closet **1** is fastened to the adapter **49** via a fixing plate **54** made of an iron plate. The fixing plate **54** has openings **55** for bolts **53**, an opening **57** for a drainage pipe **56**, and an opening **58** for the warm air outlet **32**.

As shown in FIG. **47**, the drainage pipe **56** has a widened portion **56***a* at the end thereof. The widened portion **56***a* is connected via a gasket **59** to the drainage hole **7** of the water closet **1**. Further, the widened portion **56***a* is held on the edge of the opening **57** of the fixing plate **54** via a packing **60**. The drainage pipe **56** is an elbow pipe, and is connected with a wastepipe **61** at the other end.

The bolts **53** are inserted through the bolt holes **64** of the water closet **1** via space nuts **62** and rubber packings **63**, and then threadedly engaged with decorative nuts **67** through sectional nylon packings **65** and washers **66**.

In the sides of the water closet **1**, openings **68** are provided through which the decorative nuts **67** may be clamped with a tool. A cover **69** is removably fitted over the opening **68** (FIG. **41**).

In the vertical main angle bars **50** nearer to the toilet room, screw holes are provided. The adapter **49** is fastened by rocking the screws **71** to the pillars **41** and **42** through the holes **70**. FIG. **46** shows a bay window unit **72** which is attached to the outside of the pillars **41** and **42** and covers the adapter **49**, and further a tank **73** for washing water installed in the adapter. A lidded waste trap **48***b* provided to the waterproof pan **48** is also shown. Appropriate decorative panel (not shown) or the like is disposed in the front face of the adapter **49**.

As shown in FIG. **48**, two outlets **32** are symmetrically disposed to the warm air generator **12**. The warm air duct **4** is connected with the outlet **32** to communicate the warm air generator **12** and the water closet **1**. The warm air generator **12** has L-shaped brackets **75** for attaching to the fixing plate **54** with screws (FIGS. **46** and **47**).

In the bench type water closet unit having the above structure, the water closet **1** is fastened to the box-like and frame type adapter **49**, and in turn the adapter **49** is attached to the pillars **41** and **42**. Thus, the supporting strength of the water closet is extremely high. Because the bench type water closet is used, the floor (the waterproof pan **48**) of the toilet room can be wholly washed. The washing water may be removed through the trap **48***b*.

In the above embodiment, plural bolt holes **52** are provided in the sub-angle bars at various heights, with respect to one bolt hole **64** in the water closet **1**. The height of the water closet **1** may be easily adjusted by changing the bolt hole in the sub-angle bars **51** through which the bolts **53** are inserted. The adapter **49** may be installed with protruding from the toilet room, or the bay window unit **72** may be installed, whereby the space of the toilet room may be enlarged.

FIG. **49** illustrates another embodiment wherein the water closet **1** according to the present invention is installed in a different manner. In this embodiment, a major part of the adapter **49** is installed in the inside of the pillars **41** and **42**. The main angle bar **50** in the lower front part of the adapter **49** is fixed on the sleeper **45**. The referential numerals in FIG. **49** have the meanings same as those given in FIG. **41**.

It should be understood that the detailed description as to the water closet unit with reference to the above drawings is given by way of illustration only. For example, the number of the warm air outlet, the position of

the warm air path, the structure of the warm air path (the presence or the absence of the guiding groove), the direction of the warm air blown out, or the like, may be different from those shown in the drawings. The water closet used includes the bench type, and the water closet fixed on the floor and the adapter. A device for controlling an amount of the warm air may be installed. The adapter used includes not only the frame type, but also a box which is made of plates and has appropriate openings. The shape of the adapter may be appropriately adjusted in accordance with the shape of the toilet room. The water closet of the present invention may be adjusted so as to attach the same to the wall or the like of the toilet room, instead of the pillars.

As explained, the sitting type water closet, particularly the bench type water closet, can be installed in the toilet room with an extremely high strength, using the water closet unit of the present invention. An air conditioner or the tank for the washing water may be installed within the adapter. By protruding the adapter from the building as the bay window, the inner space may be enlarged.

According to the present invention, a means for facilitating the attachment of the water closet to the adapter is provided.

In the water closet unit of the present invention, the fixing plate is attached on the adapter side facing the toilet room, and nuts are fixed on the plate, whereby the water closet can be fastened to the adapter with the bolts threadedly fittable to the nuts.

Alternatively, the bolts are fixed on the plate instead of the nuts, and the bolts are inserted through the bolts holes in the water closet, whereby the water closet can be fastened to the adapter with the nuts threadedly fittable to the bolts. Because the fixing plate having such structures is attached to the adapter, the water closet can be attached to the adapter by bringing the rear side of the water closet with the fixing plate and then fastening the bolts or nuts.

Accordingly, a register of the water closet and the fixing plate can be easily carried out, and the bolts and nuts can be easily fastened.

FIGS. **50** to **52** schematically show the condition wherein the water closet **1** is attached to the adapter **49**, using the fixing plate having such specific structure, particularly the fixing plate **54** shown in FIG. **53**.

As shown, particularly in FIG. **52**, the fixing plate **54** has through holes **163** for the bolts **162** to attach the water closet **1**. At the rear side of the water closet **1**, through holes **164** are provided for the bolts **162**. Nuts **165** threadedly fittable to the bolts **162** are fixed by welding or the like at the positions of the through holes **163** on the rear surface of the fixing plate **54** (FIG. **53**). The fixing plate **54** has a through hole **166** for a bolt **31***a* to attach the warm air generator **12**.

The fixing plate **54** is covered with a decorative panel **167**. The panel **167** includes a through hole **167***a* for the drainage pipe **56**, a through hole **167***b* for the warm air outlet **32**, through holes **167***c* for the bolts **31***a*, through holes **167***d* for the bolts **162**, or the like.

The warm air generator **12** has an L-shaped bracket **75** so as to attach the generator to the fixing plate **54** with screws (FIG. **52**). The warm air generator **12** and the decorative panel **167** are attached by inserting the bolts **31***a* through the holes **167***c* and **166** in the decorative panel **167** and the fixing plate **54**, and fastening the nuts.

To carry out the attachment of the water closet **1**, the fixing plate **54** is fixed to the adapter **49** with the bolts **53**. The warm air generator **12** and the decorative panel **167** are then fixed with the bolts **31***a*. The rear end **1***a* of the water closet **1** is brought into contact with the decorative panel **167**, and the bolts **162** are threadedly engaged with the nuts **165**. In this case, the bolts **162** can be easily engaged with the nuts **165**, which have been fastened on the back surface of the fixing plate **54**.

FIG. **54** shows another fixing plate **54'** which may be used in the present invention. The fixing plate **54'** does not have bolt holes **163** and nuts **165**. Instead thereof, stud bolts **74** are provided on the fixing plate **54'**. The water closet **1** can be attached by inserting the stud bolts **74** through the bolt holes **167***d* in the decorative panel **167** and the bolt holes **164** in the water closet **1**, and then fastening the nuts. The referential numerals in FIG. **54** have the same meanings as given in FIG. **53**. The water closet **1** can be easily attached to the adapter, using also the fixing plate **54'**.

In still another embodiment of the present invention, the warm air outlet may be arranged on the side wall of the adapter, instead of or in addition to the warm air outlet in the water closet. The warm air outlet is provided on the side wall same as that for attaching the water closet. Further, the warm air outlet is provided at a height lower than that of the top of the water closet.

When the water closet unit having such a structure is installed in the toilet room, the warm air is blown out from the lower portion of the wall behind the water closet and can rapidly heat the leg of the user. Further, the toilet room is wholly heated, too. When the warm air outlets are arranged in both of the side wall of the adapter and the lower portion of the water closet, the warm air is also blown out from the water closet, and thus, the leg of the user may be effectively heated. Further, the dew condensation of the toilet bowl and the freezing of the trap water can be avoided.

FIGS. **55** to **59** illustrate the condition wherein the adapter **49** carrying the water closet **1** fastened thereto is attached to the pillar **41** in the toilet room **20**. The adapter **49** contains the warm air generator **12** therein. The referential numerals in FIGS. **55** to **59** have the meanings as given above.

The toilet room **20** has a door **269** (FIG. **56**). The adapter **49** carries appropriate decorative panels **49**A, **49**B and **49**C on the front and upper sides thereof (FIG. **57**).

As shown in FIGS. **58** to **60**, the warm air generator **12** is included in a casing **284** which is transversely arranged behind the water closet **1**. The casing **284** further contains a turbo-fan, a resistance heating element (such as a ceramic heater element) and the like. The warm air generator **12** has the warm air pipes **282** and the warm air outlets **286** on both sides at a height lower than that of the upper face IU of the water closet. The warm air generator **12** has an intake vent **288**.

As shown in FIG. **57**, openings **290** are arranged on the front panel **49**B of the adapter **49** so that the outlets **286** face the toilet room **20**.

In the toilet room having such water closet unit, the warm air is blown out from the outlets **286** arranged on the wall of the adapter and the outlets **5** in the water closet **1**, to effect the heating and, particularly the heating of the leg of the user. When the warm air generator having the resistance heating element as a heat source is employed, the warm air with a high temperature is blown out shortly after the warm air generator is turned

on, and thus, the water closet has a good starting performance.

The warm air outlet on the wall of the adapter may be arranged at a height lower than that of the water closet, whereby the leg of the user may be heated more sufficiently. When the outlets **286** on the wall of the adapter are arranged in both sides of the water closet as in the embodiment illustrated in FIGS. **57** to **60**, the toilet room **20** may be more effectively heated as a whole. There may be arranged a device for controlling that the warm air is blown out from either the outlet **286** on the wall or the outlet **5** in the water closet. In this case, the water closet unit may be constructed so that the whole heating is effected by blowing the warm air out only from the outlet **286**, and further, the warm air is blown out from the outlet **5** when the water closet is employed.

The water closet and the water closet unit according to the present invention may be controlled in various manners by employing the seat switch.

For example, an on-off control of the warm air generator may be carried out by an on-off signal by the seat switch. In this case, when the user sits down on the toilet seat, the warm air starts to blow, and when the user stands up from the seat, the blowing-off ceases. Therefore, the electric power consumed may be saved, and this embodiment is economical.

Further, a timer may be added to the warm air generator, and at the same time, the power of the warm air generator may be made controllable. In this embodiment, when the timer is on, The warm air generator is operated under a low power to blow the warm air having a relatively low temperature. When the user sits down on the toilet seat, the warm air generator is operated under a high power to blow the warm air having a relatively high temperature during the employment of the water closet by the user. In the water closet or water closet unit wherein the timer controlling system is employed, the temperature in the whole toilet room may be elevated by blowing the warm air out when the water closet is not used.

To improve the starting performance of the whole heating of the toilet room, there may be used the system wherein the warm air generator is operated under a high power when the timer is on, and the low power is utilized if the user feels the air hot.

For example, as shown in FIGS. **41** and **42**, the seat switch **27** including the pressure-sensitive switch mechanism is disposed between the hinge shaft **25** and the upper surface of the toilet bowl **2**. The seat switch **27** is connected via the lead wire **28** with the controller **29**, and then via the signal wire **30** with the warm air generator **12**. The outlet **32** of the warm air generator **12** is communicated with the warm air duct **4**.

FIGS. **61** to **63** illustrate the structure of the seat switch **27**. The seat switch **27** is covered with cylindrical jackets **27***a*, **27***b* made of an elastic material, such as a rubber. At the end of the elastic jacket **27***a*, a pair of semicircular electrodes **27***c*, **27***d* is disposed by introducing into receptacles **27**C, **27**D in the elastic jacket **27***a*. The end of each receptacle **27**C and **27**D is connected with lead wires **28** (**28***a* and **28***b*). An insulating material **27***e* is introduced between the electrodes **27***c* and **27***d*.

An insulating spacer **27***f* in the form of a thin plate having an opening, e.g., a ring, is disposed, contacting the electrodes **27***c* and **27***d*. On the insulating spacer **27***f*, an electrically conductive, elastic (e.g., rubber) piece **27***g* and a press piece **27***h* are stacked.

In the seat switch **27**, when a compression load is applied to the elastic jacket **27***a* in an axial direction thereof, the cap-shaped elastic jacket **27***b* is deformed as press-collapsed in an axial direction. In the switch, then, the conductive elastic piece **27***g* is pressed with the press piece **27***h*. The conductive elastic piece **27***g* is deformed so that a part thereof is introduced into the opening of the insulating spacer **27***f*. Thus, the tip of the introduced part of the conductive elastic piece **27***g* contacts the electrodes **27***c*, **27***d*, whereby the electrodes **27***c* and **27***d* are connected with each other, and the seat switch is turned on.

When the compression load is removed from the seat switch **27**, the elastic jacket **27***b* recovers the original shape thereof. Thus, the conductive elastic piece **27***g* recovers the original shape, and then separates from the electrodes **27***c* and **27***d*. Therefore, the electrodes **27***c* and **27***d* separate from each other, and the seat switch **27** is turned off.

In the water closet having the above structure, when the user sits down on the toilet seat **22**, the seat switch **27** is turned on, the warm air generator **12** is then operated, and the warm air is blown out from the outlet **5**. The warm air contacts the lower half of the body, particularly the calf, of the user, thereby heating the leg of the user.

Referring to FIGS. **64** to **67**, the structure of the controller **29** and the warm air generator **12** will be explained hereinafter.

As shown in FIG. **64**, the warm air generator **12** has an electric heater (ceramic heater) **381** as a heat source. The generator further contains a propeller fan **382** as a fan. An air filter **383***a* is disposed to an intake vent **383**. The warm air generator **12** is installed within the bay window unit **72**.

The controller **29** comprises a main switch **384** for turning the whole circuit on or off, a temperature presetting device **385** for setting a standard temperature at which the electric heat **381** is operated, the timer **386**, a switch **387** for forcing the warm air generator **12** to work, and the like. The lead wire **28** from the seat switch **27** and the signal wire **30** to the warm air generator **12** are connected with the controller **29**. Further, a temperature sensor **388** to detect the temperature in the toilet room **20** is connected with the controller **29**.

The controller **29** contains a device for the control as described below, such as a sequence control circuit of microcomputer. As shown in FIG. **65**, when the user sits down on the toilet seat **22** and the seat switch **27** is turned on, the temperature in the toilet room **20** is judged if it is lower than the predetermined standard temperature (e.g., 20° C.). If the temperature is lower than the predetermined one, the electric heater **381** is turned on, the propeller fan **382** is rotated, and then the warm air is blown out from the outlet **5**. If the temperature is higher than the predetermined one, the warm air is not blown out. When the user stands up from the toilet seat **22**, the electric heater **381** is turned off and the rotation of the propeller fan **382** is stopped.

When the timer **386** is turned on (i.e., when the presetted time comes to blow the warm air out), or when the forcing switch **387** is turned on, the temperature in the toilet room **20** is judged if it is lower than the predetermined one. If the temperature is lower, the electric heater **381** is turned on, and the propeller fan **382** is rotated, and thus, the warm air is blown out.

FIG. **67** shows an embodiment wherein the timer **386** is employed. In this embodiment, the timer **386** is preset-

ted so that it is turned on only during 5:00 a.m. to 8:30 a.m., when the water closet is frequently employed. Thus, the toilet room **20** is intended to heat as a whole (arrow B).

During 5:00 a.m. to 8:30 a.m., i.e., when the timer is on, if the user sits down on the seat **22**, the electric heater **381** is operated in a full power to blow the warm air out (arrows C, D, E, F, G). During the other period of time, only if the user sits down on the toilet seat, the electric heater **381** is worked to blow the warm air as shown in arrows A and H in FIG. **67**. By continuously operating the electric heater only during the period of time when the water closet is frequently employed, as above, it is possible to save electricity, and at the same time, perform the whole heating of the toilet room. Therefore, economical and comfortable requirements may be met. Because the electric heater **381** is turned on immediately after turning on, the warm air is blown out immediately after the user sits down.

It is preferable in the above embodiment to use the electric heater which can save electricity (for example, the resistance heating element which can change the powers, for example, of 400 W and 800 W) and to blow the warm air having relatively low temperature by working the electric heater under a lower power when the timer is on (arrow B in FIG. **67**).

Further, the power of the heater may be changed between more than two levels, or continuously controlled.

According to still another embodiment of the present invention, the seat switch brings about another control system. The present invention also provides a water closet or a water closet unit comprising the warm air path [(i) the warm air duct and optionally (ii) the warm air guiding groove] for blowing the warm air out to the leg of the user from the lower portion of the water closet installed to the toilet room, the warm air generator [(i) the blower arranged in the warm air duct, for generating the air stream flowing to the leg of the user, and (ii) the electric heater arranged in the warm air duct, for heating the air stream flowing through the duct, when turned on], and a controlling device which applies an electric current to the electric heater when the user of the water closet sits down on the toilet seat, but restrains an amount of the air from the blower until a given period of time elapses.

In the above embodiment, the electric heater is turned on, when the user sits down on the water closet installed in the toilet room. Further, the amount of the air from the blower is restrained, until the given period of time elapses after the user sits down on the water closet. Therefore, the heat radiation from the electric heater is prevented, and thus, the heater can rapidly go up to the predetermined temperature. After the given period of time elapses, the blower starts to work for conveying a given amount of the warm air. Then, the warm air heated up to the predetermined temperature is blown out from the outlet of the warm air duct disposed in the lower portion of the sitting type water closet to the leg of the user. Therefore, this embodiment can prevent cold air from blowing out, and a cool touch to the user can be avoided, shortly after the electric heater starts to work.

FIGS. **68** to **70** illustrate the toilet room including the water closet unit of the above embodiment. FIGS. **71** and **72** show a leg heater contained in the warm air generator.

The water closet unit **401** comprises a heat pump type air-conditioner **403** for wholly heating the toilet room **20**; a ventilating duct **404** for blowing the warm air out into the toilet room **20**; the blower **452** arranged in the warm air duct **404** for generating the air stream to the leg of the user; and the leg heater **405** for heating the air passing through the ventilating duct **404**. The water closet unit **401** is connected with the control panel **406**.

The toilet room **20** comprises a side wall **422** carrying the door **269**; a side wall **424** carrying a container cabinet **423** for toilet paper; a side wall **425** carrying the control panel **406**; the bay window unit **72** protruding outwardly; a resin floor **48**; and a ceiling **429** carrying an air fan. The bay window unit **72** comprises a side wall **426***a*, and a counter **426***c* which is arranged in the front wall **426***b* and contains the air-conditioner **403** and the leg heater **405** therein.

The air-conditioner **403** is a window fan type, and fastened on the rear face of the side wall **426***d* of the counter **426***c*. The air-conditioner **403** is contained in the adapter **49** comprising the counter **426***c* and the side wall **426***b*. The air-conditioner **403** may contain a refrigeration cycle (not shown) within a unit case **431**. Grilles **432** are provided to the outlet arranged on the front wall of the unit case **431**, and an intake vent (not shown) and an outlet (not shown) arranged on the side wall of the unit case **431**. The ventilating duct **404** comprises an intake duct **441** for inhaling the air present in the toilet room **20**; a heater duct **442** connecting with the intake duct **441**; and two warm air ducts **4** formed integrally on the lower portion of the toilet bowl **2** and connected with the heater duct **442**.

The intake duct **441** has an intake vent **444** which faces the toilet room **20** to inhale the air present therein, and is arranged at the back of the grill **432** of the air-conditioner **403**. The heater duct **442** is disposed to the leg heater **405**. The warm air duct **4** has the warm air outlet **5** which has an opening near to the leg of the user, and blows the warm air out to the leg exposed when the user employs the water closet. From the warm air outlet **5** to the tip of the water closet **1**, there is provided the warm air guiding groove **8** so as to minimize the reduction of the temperature of the warm air.

The leg heater **405** comprises a casing **451** for heat insulating the heater duct **442** from the air; an axial flow fan or the blower **452**, which is arranged in the heater duct **442** and generates, in the heater duct **442**, the air stream to the toilet room **20**; two harmonica type positive thermistor cells (hereinafter referred to as PTC heater) **453** which are arranged in the heater duct **442**, and heat the air passing therethrough.

The casing **451** has a parallelepipedic shape, and is fastened to the rear side of the side wall **426***b* of the counter **426***c*, with the fixing stays **451***a* welded to the casing **451**.

The casing **451** carries, on a side plate **451***b*, a connector **454** for applying the electric current to the axial flow fan **452** and the PTC heater **453**. Further, on the casing **451**, a tail end **442***a* of the side plate **451***b*, and a two-way tail end **442***b* of the heater duct **442** is outwardly protruded from the other side plate **451***c*.

The axial flow fan **452** can serve to blow out a given amount of the air from the warm air outlet **5** to the exposed leg of the user, when received a given amount of electric current from the control circuit **466**. When the axial flow fan **452** receives electric current from the control circuit **466** in an amount less than the predetermined one, the fan serves to blow the air to the exposed

leg of the user in an amount less than the predetermined one.

The PTC heater **453** is formed by arranging many positive thermistor cell plates **455** [comprising conductive ceramics mainly composed of barium titanate ($BaTiO_3$), or the like] between a positive electrode plate **456** and a negative electrode plate **457**. The PTC heater is formed so that the resistance thereof is suddenly increased at a given Curie point, by introducing various additives.

The PTC heater **453** makes use of the PTC characteristic property to maintain the surface temperature at a constant level by a current restriction function in the area where the resistance is suddenly changed. The Curie point of the PTC heater **453** is set to the temperature (e.g., 300° C.) lower than an ignition point (e.g., 400° C.) of dust or the like so that the surface temperature (almost the same temperature as Curie point) of the PTC heater **453** is set to the temperature lower than the ignition temperature of the dust.

FIG. **73** shows a block diagram of the built-in control circuit of the control panel.

The control panel **406** carries, on the entire front surface thereof, a switch **461** of the leg heater, a switch **462** of the air-conditioner, and a switch **463** for changing an air-cooling and an air-heating. The control panel **406** contains a control circuit **466** as a controlling device to receive signals from the leg heater switch **461**, the air-conditioner switch **462**, the cooling/heating-changing switch **463**, the seat switch **27** and timer **465**.

The leg heater switch **461** is a manual switch which gives to the control circuit **466** on-off signals of the leg heater **405**, i.e., the axial flow fan **452** and the PTC heater **453**. The leg heater switch **461** has three positions, i.e., "off", "weak", and "strong". The "weak" means one of the PTC heaters **453** is on, and the "strong" means two PTC heaters **453** are on.

The air-conditioner switch **462** is a manual switch which gives to the control circuit **466** on-off signals of the air-conditioner **403**.

The cooling-heating changing switch **463** is a manual switch for changing the air-cooling to the air-heating, and vice versa.

The seat switch **27** is disposed under the toilet seat **22** of the water closet **1**. When the seat switch **27** detects that the user sits down on the water closet **1**, the seat switch **27** sends a sitting signal to the timer **465** and the control circuit **466** so that the axial flow fan **452** and the PTC heater are turned on. The seat switch **27** contains a pressure-sensitive switch which changes the resistance thereof by the weight of the user who sits down on the water closet **1**, and sends the on-signal to the timer **465** and the control circuit **466** so that the leg heater **405** is turned on.

The timer **465**, when receiving the on-signal from the seat switch **27**, gives an off-signal to the control circuit **466** so as to defer operating the axial flow fan **452** for a given period of time (for example, for 5 seconds).

The control circuit **466** performs, in accordance with the input signals received, the on-off control of the air-conditioner **403**, the axial flow fan **452** and the PTC heater **453**, via an electrical box **467**. Further, the control circuit **466** turns the axial flow fan **452** off to restrain the amount of the air from the fan **452**, during a period of time when the circuit **466** receives the off-signal of the fan **452** from the timer **465**.

The electrical box **467** is arranged in the upper portion of the unit case **431** of the air-conditioner **403**, connected with a domestic electric source (100 V), and supplies an electric current to the air conditioner **403**, the axial flow fan **452** and the PTC heater **453**.

The operation of the leg heater **405** in the control circuit **466** according to the above embodiment will be explained, referring to FIG. **74**.

First, a judgement is made if the leg heater switch **461** is on (or strong or weak) or off (step **S1**). When the leg heater switch **461** is off (No), the PTC heater **453** is turned off (step **S2**) and the axial flow fan **452** is turned off (step **S3**). Thereafter, the step **S1** is repeated.

When the leg heater switch **461** is on (Yes) in the step **S1**, a judgement is made if the seat switch **27** is on (step **S4**). When the seat switch **27** is off (No), the step **S2** is selected.

If the user of the water closet **1** sits down on the toilet seat **22** in this situation, the resistance of the seat switch **27** is changed by the weight of the user. Then, the seat switch **27** sends the on-signal for turning the leg heater **405** on to the timer **465** and the control circuit **466**.

As above, when the seat switch **27** is turned on (Yes), the PTC heater is turned on (step **S5**), and the axial flow fan **452** is turned off (step **S6**).

The PTC heater **453** has a large hear capacity, and thus, can not be rapidly elevated to the predetermined temperature. If the PTC heater **453** in this condition is brought into contact with a fresh air (not heated) by the axial flow fan **452**, the time necessary to elevate the temperature of the heater **453** per se to the predetermined one becomes longer. As a result, the air having a relatively low temperature is blown out from the warm air outlet **5** to the leg of the user.

If the air not heated is blown out to the leg of the user shortly after the PTC heater **453** begins to work, the undressed user would feel the touch cooler than that the user feels when dressed. The user sitting on the seat **22** can not but receive the cool air at the leg. Therefore, it is necessary to introduce a means for avoiding the cool touch from the user, in the water closet **1** carrying the leg heater **405** and the warm air outlet **5** therefor on the lower portion of the closet.

In the above embodiment, accordingly, the axial flow fan **452** is maintained to be off, until a given period on time (e.g., 5 seconds) elapses after the seat switch is turned on (step **S7**), to restrain the amount of the air blown. The PTC heater **453** stands under the windless condition, and the heat radiation therefrom is prevented, whereby the heater is rapidly elevated to the predetermined temperature.

Accordingly, it is avoided that the cool air is blown out to the leg of the user shortly after the PTC heater **453** is operated. Thus, the cool touch can be remedied.

After the predetermined period of time, the axial flow fan **452** is turned on to produce the air stream in the ventilating duct **404** (step **S8**). When the axial flow fan **452** is on, the air present in the toilet room **20** is sucked into the intake duct **441** from the intake vent. The air sucked into the intake duct **441** is introduced into the heater duct **442**, heated to the predetermined temperature with the PTC heater **453**, and then conveyed to the warm air duct **4**. The warm air introduced into the warm air duct **4** is blown out from the outlet **5**, blows along the guiding groove **8**, on the closet, and reaches the leg of the user, thereby sufficiently heating the user.

In comparison with the case wherein the axial flow fan is turned on immediately after the PTC heater **453** is turned on, the user can feel the improved touch as shown in Table 1 by deferring the operation of the axial

flow fan **452** until the predetermined period of time elapses.

TABLE 1

Time after turning seat switch on (sec.)	Turning fan and PTC heater on	Deferring fan 5 sec., but turning heater on
0–15	cool touch	no feeling
15–20	no feeling	no feeling
>20	warm touch	warm touch

(Temperature of toilet room 20 is 3° C.)

As shown in Table 1, when the axial flow fan **452** and the PTC heater **453** are simultaneously turned on, the user feels the cooling air stream for about 15 seconds after the fan and heater begin to work. The user does not feel the cooling or warm touch about 15 to 20 seconds later, and then becomes to feel the warm touch about 20 seconds later.

On the other hand, when deferring the operation of the fan, the user does not feel the cool touch even for about 15 seconds immediately after the PTC heater **435** is turned on, whereas the warm touch can be obtained about 20 seconds later. This means that the heating effect is not affected.

As above, the cool touch shortly after the PTC heater **453** is turned on can be avoided, and the rapid heating effect can be satisfactorily obtained.

FIG. **75** shows the flow chart of another operation of the leg heater **405** in the control circuit **466**. The explanation of the operations described with reference to FIG. **74** will be omitted.

In this embodiment, not only the PTC heater **453**, but also the axial flow fan **452** are turned on at the same time until the predetermined period of time elapses, but the fan is operated under the condition to flow a small amount of the air out, namely, the air in an amount smaller than the predetermined normal amount (step **S9**).

The word "small amount of the air" or the like used herein means the amount which does not give the user the cool touch.

Although the above embodiments are described with respect to the counter type adapter, the frame type adapter may also be used. Instead of the PTC heater, an electric heater such as a nichrome wire heater may also be employed.

According to the present invention, there is provided a means for remedying the defects caused by the PTC heater used as the heating means in the warm air generation.

When the PTC heater is used under a reducing atmosphere such as hydrogen sulfide which is one of malodor components in the toilet room, the PTC characteristics can be changed by reduction. FIG. **76** is a graph showing the relationship between the surface temperature of the PTC heater and a ratio of resistance at a given temperature to that at 25° C. (R_{25}). When the PTC characteristics are changed, and the PTC resistance curve is changed from the curve I to the curve II. As a result, the operation point which is the intersection point of a wind velocity v (m/s) and the PTC resistance curve is moved from the point A to the point B. The surface temperature of the PTC heater is elevated by ΔT° C. Therefore, the conventional heating apparatus for the toilet room which apparatus employs the PTC heater has a problem that the PTC heater encounters the reduction deterioration when used for a long time, and then the PTC properties are changed. As a result, the surface temperature of the PTC heater, and thus, the temperature of the toilet room is elevated, whereby the heating feeling is lowered.

Accordingly, the present invention provides a combination of an outside air introducing type ventilating duct which inhales the air present outside the toilet room and blows out into the toilet room, a blower which is arranged in the ventilating duct and produces the air stream into the toilet room, and the PTC heater which is arranged in the ventilating duct and heats the air.

The above structure brings about the following advantages. The air present outside the toilet room is blown out into the toilet room by the blower, and thus the PTC heater is not exposed with the reducing gas such as hydrogen sulfide present in the toilet room, whereby the elevation of the surface temperature of the positive thermistor caused by the reduction deterioration can be avoided.

Further, the PTC heater can maintain the surface temperature thereof in a constant level. Therefore, when the temperature of the air outside the toilet room is lowered, the difference between the surface temperature of the PTC heater and that of the outside air is increased, and thus the heat release value is increased. Thus, the heated air blown out into the toilet room has a constant temperature, independently of the variation of the outside temperature. Further, the heating feeling is not lowered, even if the outside air has a low temperature.

FIG. **77** shows an embodiment wherein the above water closet is installed. The water closet unit **501** is arranged within the counter **523** disposed on the side wall **522** which is protruded to the outside **521** of the toilet room **20**. The water closet **1** is attached to the side wall **423***a* of the counter **523**. The counter **523** and the side wall **423***a* form the adapter.

The water closet **501** comprises the outside air introducing type ventilating duct **503** for blowing out the air (referred to as outside air) present outside **521** of the toilet room **20** (e.g., the outsides, or the adjoining room), and the warm air generator **12** arranged within the ventilating duct **503** comprises a bellows duct **531** for introducing the outside air, a chamber **532** connected with the duct **531**, a bellows duct **533** connected with the chamber **532**, the warm air duct **534** connected with the duct **533**, and two warm air ducts **4** which are diverged from the warm air duct **534** and blow the warm air out to the leg of the user. An intake vent **531***b* having a hood **531***a* is arranged to the tip of the duct **531**. The chamber **532** forms a space having a sectional area larger than those of the ducts **531** and **533**, so as to reduce the pressure and control the variation caused by the wind as to the amount of the inhaled air. In the chamber **532**, a filter **532***a* is disposed to adsorb the dust included in the outside air.

Heat insulating materials are disposed to the bifurcated ends **534***c* of the ventilating duct **534**. Between the bifurcated ends **534***c* of the ventilating duct **534** and the warm air duct **4**, there are provided sealing materials **534***a* and **534***b* to leak the warm air. At the end of the warm air duct **4**, there is an opening between the lower portion of the water closet **1** and the floor **48** to form the warm air duct **4**.

The warm air generator **12** comprises the casing **451** which covers the ventilating duct **534** with a gap therebetween to assure insulation with the air, the blower or

the axial flow fan **452** which is arranged within the ventilating duct **534** and generates the air stream to the inside **425** of the toilet room **20**, and two PTC heaters which are arranged within the ventilating duct **534** and heats the air stream passing therethrough.

The warm air generator and the like contained in the water closet unit **501** are turned on, when the pressure-sensitive seat switch **27** disposed under the toilet seat **22** of the water closet **1** is turned on. When the user sits down on the water closet **1**, the resistance of the seat switch is changed by the weight of the user, and thus, the switch sends on-signals to the axial flow fan **452** and the PTC heater **453**. When the user stands up, the resistance is changed, and the switch sends off-signals to the axial flow fan **452** and the PTC heater **453**. When the user stands up, the resistance is changed, and the switch sends off-signals to the axial flow fan **452** and the PTC heater **453**.

The axial flow fan **452** is rotated upon the receipt of the on-signal, and the outside air present in the outside **521** of the toilet room **20** is sucked through the outside air intake vent **531***b* to the ventilating duct **503**. The sucked air is introduced into the chamber **532** via the duct **531**. Relatively large dusts contained in the outside air are caught by the filter **532***a*.

After passing through the chamber **532**, the outside air is conveyed to the ventilating duct **534** via the duct **322**.

The Curie point of the PTC heater **453** is presetted to the point below the ignition temperature of the dust contained in the outside air. Upon receiving the on-signal, the PTC heater **453** consumes a large amount of the electric current to generate the heat, when the outside air has the low temperature, namely the resistance of the PTC heater is low. If the surface temperature is elevated to the temperature above the presetted Curie point, the resistance is rapidly increased. Then, the amount of the current consumed is restrained, and a constant surface temperature may be maintained, whereby the surface temperature may be maintained under the ignition temperature of the duct.

Because the air heated by the PTC heater **453** is the outside air which is introduced into ventilating duct **534** and is free from the reducing gases such as hydrogen sulfide, the reduction deterioration causing the elevation of the surface temperature of the PTC heater may be avoided, and thus, the ignition of foreign substances such as the dust adsorbed to the heater may be prevented. A reliable heating apparatus for the toilet room may be provided.

Further, the PTC heater **453** has a constant surface temperature. When the temperature of the outside air is lowered, the surface temperature of the PTC heater **453** becomes largely different from the temperature of the outside air. Then, the PTC heater may reduce the resistance thereof, consume a large amount of the current, and increase the heat (W) generated, whereby the reduction of the temperature of the outside air may be compensated by the increase of the heat generated. Therefore, the warm air outlet **5** of the warm air duct **4** can blow out the warm air heated by the PTC heater and having a constant temperature, regardless of the variation of the temperature of the outside air. Accordingly, the deterioration in the heating feeling can be prevented.

The temperature drop of the warm air blown out from the warm air outlet (caused by the temperature drop of the outside air) can be more effectively prevented. The amount of the air blown out can be controlled in accordance with the outside air temperature determined through a sensor for detecting the temperature of the outside air. For example, when the temperature of the outside air is lowered, the amount of the air blown out may be reduced to thereby maintain a constant temperature of the warm air at the warm air outlet.

The warm air outlet may be arranged on the side wall, ceiling, floor, or the like of the toilet room. Although the PTC heater may be formed by placing plural PTC heater plates by the side of another, the PTC heater may be produced from a single PTC heater. Further, an open-off valve may be disposed to the warm air duct so as to open and close the duct, dependently upon the necessity of the heating. Alternatively, an air-conditioning apparatus, such as an air-cooling apparatus, an air-cooling and heating apparatus, a ventilating apparatus may be installed in addition to the air-heating apparatus.

The PTC heater exhibits a function to control the amount of the current at the area where the resistance is suddenly increased from the point corresponding to the Curie point. Thus, the PTC heater has the property that the temperature thereof is not elevated above a given temperature. In general, the PTC heater does not require a protection device for overheating.

In the toilet room, however, the PTC heater employed in the heating apparatus can adsorb the dust from paper, clothes, or the like, which dust usually flies therein. The PTC heater employed in the heating apparatus for the toilet room is usually presetted to the temperature at which the dust from paper, clothes or the like does not ignite, by virtue of the function of controlling the current.

When the PTC heater is reduced with the reducing substances, however, the resistance increase caused by the temperature elevation becomes smaller. In other words, the current controlling function is lost if the PTC heater is reduced. The PTC heater can abnormally generate the heat. If the PTC heater is overheated, the PTC heater can reach the temperature at which the dust from paper, clothes or the like can ignite.

Further, if the PTC heater is overheated, the user can feel uncomfortable touch in the air overheated and blown out from the heating apparatus for the toilet room.

According to the present invention, there is provided a combination of the ventilating duct for conveying the air into the toilet room; the blower for generating in the ventilating duct the air stream to the toilet room; the PTC heater which is arranged within the ventilating duct, generates the heat when turned on, and increases the resistance thereof as the temperature is elevated; a safety means for turning the PTC heater off when the PTC heater is heated to the predetermined temperature.

In the above embodiment, the PTC heater is turned off by the safety means, if the PTC heater arranged in the ventilating duct is reduced with the reducing substances such as hydrogen sulfide, ammonia or the like contained in the air of the toilet room, thereby being rendered into the state where the resistance increase can not be obtained with the temperature elevation; and then, the PTC heater is overheated to the predetermined temperature which is the temperature near to the ignition point of the dust, such as paper, fiber from clothes, or which is the temperature giving the uncomfortable feeling to the user.

FIG. 79 shows an example wherein the above embodiment is installed in the water closet unit. The water closet unit **601** has the ventilating duct **604** for conveying the air from the lower portion of the toilet bowl **2** in the water closet **1** to the leg of the user. The duct **606** with the box disposed in the air-conditioner box **605** or adapter arranged at the rear side of the water closet **1** is connected with two ducts **4** integrally formed with the water closet **1** (FIG. **70**) through the ventilating duct **604**.

The duct **606** within the box comprises an intake duct **609** for inhaling the air in the toilet room **20**, a bellows duct **610**, and a heater unit **611**. The intake duct **609** has a grill **432** in the upstream portion of the opening. In the grill **432**, a filter **613** is provided to prevent the paper or the fiber of the clothes from entering the heater unit **611**. The bellows duct **610** is a duct for guiding the air sucked from the intake duct **609** to the heater unit **611**.

At the upstream portion of the heater unit **611**, the blower **614** to generate in the ventilating duct **604** the air stream into the toilet room **20**. This type of the blower **614** comprises the axial flow fan **451** disposed within the cylindrical resin blowing duct **615**. A heat insulating duct **618** made of a heat insulating material follows the downstream portion of the blower **614**. The insulating duct **618** contains therein a first PTC heater **619** and a second PTC heater. A heat insulating material **614** is interposed therebetween. The first PTC heater and the second PTC heater generate the heat when turned on, and the resistance thereof is suddenly increased from the Curie point. In this embodiment, the Curie point is presetted, for example, to 220°–250° C. which is lower than about 350° C., i.e., the ignition temperature of the paper, fiber of clothes, or the like. The first or second PTC heater **619** or **620** is an assembled article manufactured by laminating plural PTC heater plates with gaps therebetween in the form of a harmonica. The heater is arranged so that the air passes through the gaps between the PTC heater plates.

FIG. **80** shows an electrical circuit **624** for the on-off control of the first PTC heater **619** and the second PTC heater **620**. The first PTC heater **619** and the second PTC heater **620** are connected with each other in parallel, and can be connected with a commercial alternating source **624**, if the main switch **623** is manually turned on by the user. The second PTC heater has a sub-switch **625** which is connected with the second PTC heater in series and can manually turn only the second PTC heater **620** on and off. In the case that the main switch **623** is on, both of the first and second PTC heaters **619** and **620** are turned on, if the sub-switch **625** is turned on. In the above case, only the first PTC heater **619** is turned on, if the sub-switch **625** is turned off.

In the circuit of the first and second PTC heaters **619** and **620**, temperature fuses **626** and **627** are interposed in series. Temperature fuses **626** and **627** are the safety means in this embodiment. If an atmosphere temperature is elevated up to the predetermined value, fuses are melted to break the circuit of the first and second PTC heaters **619** and **620**. As shown in FIG. **79**, temperature fuses **626** and **627** are arranged in the insulating duct **618** via heat-resistant insulating material, such as a mica plate **628**, so that the warm air immediately after passing each of the first and second PTC heaters **619** and **620** touches directly the temperature fuse, respectively. The fuses **626** and **627** are formed to melt, if the first or second PTC heater is elevated up to the predetermined temperature, e.g., about 320° C., which is lower than the ignition point of the dust of paper or clothes, e.g., about 350° C. A current fuse **629** shown in FIG. **80** is a fuse for protecting the circuit by melting upon encountering overcurrent.

The operation of the above embodiment will be explained hereinafter. The user turns the main switch **623** on, and then, the blower **614** is turned on through a circuit (not shown), for example, when he feels the toilet room is cold. The air present in the toilet room **20** is sucked through the intake duct **609**, and blown out from the warm air duct **4** in the water closet **1** to the leg of the user.

If not only the main switch **623**, but also the sub-switch **625** are on, the first and second PTC heaters are turned on to generate the heat.

As shown in FIG. **81**, the first and second PTC heaters have a resistance-temperature characteristics (curve A) that the heat is generated after turning on and the resistance is suddenly increased from the Curie point. In the ventilating duct **604**, the air stream is produced by the blower **614**. The temperature of the first or second PTC heater is determined by the crossing point C of the resistance-temperature characteristic curve A with the operation curve B defined by the amount of the air produced by the blower, the temperature of the air sucked, and the like.

The air blown out by the blower **614** to the leg of the user passes through either the heated first or second PTC heater **619** or **620**. As a result, the air which has passed through the ventilating duct **604** is blown out as a relatively warm air from the lower portion of the toilet bowl **2** in the water closet **1** to the leg of the user (high operation).

When the main switch **623** is on, but the sub-switch **625** is off, only the first PTC heater **619** is worked, but the second PTC heater **620** is not turned on. As a result, the air passing through and heated by the first PTC heater **619** and the air passing through but not heated by the second PTC heater are agitated in the ventilating duct **604** at the downstream area of the first and second PTC heaters, and thus, the warm air having a relatively low temperature in comparison with that in the high operation is blown out to the leg of the user (low operation).

The air present in the toilet room **20** can contain the reduceing substances, such as hydrogen sulfide or ammonia formed from a detergent for the water closet **1**.

If the PTC heaters **619** and **620** are exposed to the reducing substances, and then reduced therewith, the heaters do not exhibit the resistance elevation as the temperature elevation, as shown in FIG. **81** (curve D). In other words, the PTC heaters **619** and **620** lose the function to control the current as the temperature evevation, when reduced. The temperature of the reduced PTC heater **619** or **620** is elevated to the crossing point E of the operation curve B and the resistance-temperature characteristic curve D.

If at least one of the first and second PTC heaters **619** and **620** is reduced and elevated up to the predetermined temperature of 320° C., the temperature fuse **626** or **627** arranged at the downstream area of the overheated heater is melted to turn the PTC heaters **619** and **620** off.

As above, when at least one of the first and second PTC heaters **619** and **620** reaches 320° C., the safety means or the temperature fuse **626** or **627** is melted to cease the application of the current to the PTC heaters **619** and **620**. Therefore, dusts adsorbed to the PTC

heaters do not ignite. Further, the uncomfortable feeling caused by the unusual heat generation can be avoided.

If only one safety means is provided to the understream area of plural PTC heaters, the overheat generation can not be detected. This is because that some PTC heaters are reduced to generate the overheat, and a part of PTC heaters including the reduced PTC heaters as above is turned on, the temperature of the air heated thereby can be lower than that obtained by using all of the normal (not reduced) PTC heaters. Therefore, it is necessary to arrange the safety means (temperature fuse **626**) for detecting the abnormal heat generation of the first PTC heater, and the safety means (temperature fuse **627**) for the second PTC heater. If the first PTC heater is elevated to the predetermined temperature, when only the first PTC heater is operated (low operation), the abnormal heat generation of the first PTC can be detected.

Further, the safety means comprises the temperature fuses **626** and **627** connected with the first and second PTC heaters in series. Therefore, if one of the first and second PTC heaters generate the abnormal heat, both of the first and second PTC heaters are turned off.

FIG. **82** illustrates the embodiment wherein the temperature fuses **626** and **627** are attached to the heat-resistant insulating material **614** supporting the first and second PTC heaters.

It is possible to connect one temperature fuse (two in total) in parallel with each of the first and second PTC heaters and cease the current application only to the PTC heater causing the abnormal heat generation. Any number (one, or three or more) of PTC heaters may be disposed in the ventilating duct. The safety means may be used for the PTC heater to the wholly heating apparatus of the toilet room.

The seat switch (which is turned on when the user sits down on the water closet) may be connected with the main switch in series. A deferring circuit for postphoning the start to operate the blower for a given period of time may be arranged, thereby preventing the cool air from blowing the user shortly after the seat switch is turned on. Further, after user stands up from the water closet, the blower may continue to operate for a given period of time, to thereby prevent the deformation of the ventilating duct with a remaining heat.

A temperature sensor for detecting the temperature of the PTC heater may be used as the safety means instead of the temperature fuse. Using the temperature sensor, it is possible to control the current application to the PTC heater in accordance with the outlet from the sensor. Further, the current application can be controlled in accordance with the current amount or voltage of the PTC heater.

According to the preferred embodiment of the present invention, there is provided a water closet unit comprising

(a) a wholly heating device for heating all over the toilet room,

(b) a sensor device for detecting an entrance into and an exit from the toilet room by the user thereof, and

(c) a control device which ceases an operation of the wholly heating device, and, at the same time, actuates the warm air generator included in the water closet unit, to thereby perform a partial heating, when the sensor device detects the entrance of the user, and on the other hand, which actuates the wholly heating device, and, at the same time, ceases the warm air generator to thereby stop the partial heating, when the sensor device detects the exit of the user.

The above water closet unit brings about the following advantages.

When the toilet room is empty, all over the room is heated with the wholly heating device.

When the user enters the toilet room, and the sensor detects the entrance thereby, the operation of the wholly heating device is stopped, whereas the electric heater and the blower start to operate. Therefore, the heated air is blown out from the water closet or the portion around the closet to the leg of the user.

When the user stands up from the water closet and the sensor detects the exit of the user from the toilet room, the electric heater and the blower are stopped operating, whereas the wholly heating device again starts to operate, thereby heating all over the toilet room.

As above, using the sinsor means, the control is made to change the operation of the air-conditioner from the whole heating to the partial heating (electric heater), and vice versa.

Because the wholly heating device is changed to the electric heater in the heating means, when the user enters the toilet room, the cool touch caused by the blown air having the low temperature can be avoided.

The high temperature air heated with the electric heater is applied to the exposed leg of the user, whereby the user can be rapidly and concentratedly heated at the portion where the user feels particularly cold. Further, because the operation of the wholly heating device is stopped when the user is in the toilet room, the cool feeling can be avoided, whereby the user can enjoy a comfortable atmosphere from the entrance into the room to the exit therefrom. The electric heater is operated for a short period of time when the user is in the room, and the cost can be saved.

The water closet unit of the above embodiment will be explained with respect to FIGS. **68** to **70**, and **83** to **86**.

The water closet **401** comprises, in addition to the leg heater **405** as the partially heating device for blowing the warm air out to the leg of the user, the heat pump type air-conditioner **403** for wholly heating all over the toilet room **20**, and the control panel **406** for controlling the air-conditioner **403** and the leg heater **405**.

A cubic frame type adapter **49** of stainless steel is installed within the bay window unit **72** to contain and fix the air-conditioner **403** and the leg heater **405**. On the front surface of the cubic frame type adapter **49**, the water closet **1** is attached thereto at the rear side of the closet with the bolts via a reinforced iron plate **726***b*. The bay window unit **72** contains therein toilet devices, such as the washing water tank **73**, or the drainage pipe **56**.

The air-conditioner **403** serves as the wholly heating device in this embodiment, is a wind-fan type, and is contained in the cubic frame type adapter **49**. The air-conditioner **403** is floatingly attached via a rubber mount **732** to a slide pan **731** fixed to the adapter **49** with bolts, whereby vibration of the water closet unit can be avoided by preventing transmission of vibration of the air-conditioner **403** to the bay window unit **72**. A unit case **733** for the air-conditioner **430** is connected with the domestic electric source, and contains an electric box for supplying electric current to the air-conditioner **403** and the leg heater **405**. The unit case **733** contains an inside air circulating duct **735** which is connected with

the toilet room **20**, and an outside air circulating duct **736** which is separated from the inside air circulating duct **735** with interstructures or the like and is connected with the outside of the toilet room **20**.

A refrigerating cycle of the air-conditioner **403** comprises a compressor **730***a* for a refrigeration medium, a heat exchanger **730***b* for the inside of the room, a heat exchanger **730***c* for the outside of the room, a four-direction valve **730***d*, a vacuum device (not shown), and refrigeration medium pipes (not shown) for connecting the above components with each other.

The compressor **730***a* may compress the refrigeration medium sucked, and discharge the refrigeration medium with a high temperature and a high pressure.

The heat exchanger **730***b* for the inside of the room is disposed within the inside air circulating duct **735**, and serves as a condenser to cool and condense the refrigeration medium having a high temperature and a high pressure and supplied from the compressor **730***a* upon a heating operation.

The heat exchanger **730***c* for the outside of the room is disposed within the outside air circulating duct **736**, and serves as an evaporator to evaporate the refrigeration medium having a low temperature and a low pressure and supplied from the vacuum device by absorption of the heat from the atmosphere.

The four-direction valve **730***d* changes the flow directions of the refrigeration medium, and the refrigeration cycle from the heating operation to the cooling operation, and vice versa.

The vacuum device reduces the pressure of the refrigeration medium.

The inside air circulating duct **735** contains the heat exchanger **730***d* for the inside of the room, and a blower **735***a* for the inside of the room. By the blower **753***a*, the air present inside the room **20** is sucked from an intake vent **735***c* having a filter **735***b*, blown to the heat exchanger **730***b* for the inside of the room, and then blown from the outlet **735***d* to the inside of the toilet room **20**. The filter **735***b* comprises a foam material which can adsorb the dust, and further may contain a deodorizer such as an activated carbon, an aromatic to neutrize the toilet odor, or the like.

The outside air circulating duct **736** contains the heat exchanger **730***c* for the outside of the room, and a blower **736***a* for the outside of the room. By the blower **736***a*, the air present outside the toilet room **20** is sucked from an intake vent **736***b*, blown to the heat exchanger **730***c* for the outside of the room, and discharged from the outlet **736***c* to the outside of the toilet room.

On the front surface of the unit case **733**, a grill **733***a* is disposed to cover the intake vent **735***c* (having the filter **735***b*) and the outlet **735***d*.

When the PTC heater **453** is turned on, the air passing through the ventilating duct **404** is heated by the PTC heater **453**.

The leg heater **405** is attached to the reinforced iron plate **726***b* with bolts so that the warm air outlet **426***a* of the heater case **426** is connected with the inlet **426***a* of the warm air duct **4**, at the rear end of the water closet **1**.

When the user enters the toilet room **20** and sits down on the toilet seat **22** on the water closet **1**, the resistance of the seat switch **27** is changed by the weight of the user. The seat switch **27** is disposed under the toilet seat **22** of the water closet **1**. The seat switch **27**, when detecting the user sitting down on the seat, sends a signal to a control device (not shown) to turn the blower **452** and the PTC heater **453** on, and the air-conditioner **403** off. Further, the seat switch **27**, when detecting the user standing up from the seat, sends a signal to the control device to turn the blower **452** and the PTC heater **453** off and the air-conditioner **403** on.

By virtue of the above structure, the heating means is changed from the air-conditioner **403** to the PTC heater when the use enters the toilet room, and so, the cool touch caused by the warm air having a relatively low temperature and blown out from the air-conditioner can be avoided.

Further, the warm air heated by the PTC heater **453** and having a relatively high temperature is brought into contact with the exposed leg of the user, and so, the user is rapidly heated, concentratedly at the portion where the user particularly feels cool. The temperature in the toilet room **20** can be maintained if the operation of the air-conditioner **403** is stopped, whereby the user can enjoy the comfortable atmosphere from the entrance to the exit. The PTC heater **453** is operated for a relatively short period of time when the user is in the toilet room **20**, the cost for the operation may be saved.

The temperature when the toilet room is not employed is presetted to the level where the user does not feel warm, as well as cool, and the leg of the user can be heated when the seat switch is on. In this embodiment, the cost saving may be improved.

The present invention also relates to a prefabricated toilet room unit wherein the water closet unit is installed. The prefabricated toilet room unit can be manufactured by a conventional method, using the water closet unit as mentioned above.

Although the present invention has been described with reference to specific embodiments, various changes and modifications obvious to those skilled in the art are deemed to be within the spirit, scope and concept of the invention.

We claim:

1. A sitting type water closet adapted to be mounted in a toilet room comprising: a toilet bowl having a rear portion, a front portion and interior and exterior surfaces; a warm air path extending through said bowl between said interior and exterior surfaces from a warm air inlet defined in a rear surface of said bowl to a warm air outlet disposed in a front portion of said bowl; a warm air generator comprising a blower and a positive thermistor cell connected to said warm air inlet to provide a flow of warm air through said warm air path and into said toilet room; and an intake vent connected between said warm air generator and a location outside of said toilet room.

2. A sitting type water closet according to claim **1**, further comprising a safety means connected to said positive thermistor cell for ceasing application of an electric current to said positive thermistor cell when said positive thermistor cell reaches a predetermined temperature.

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